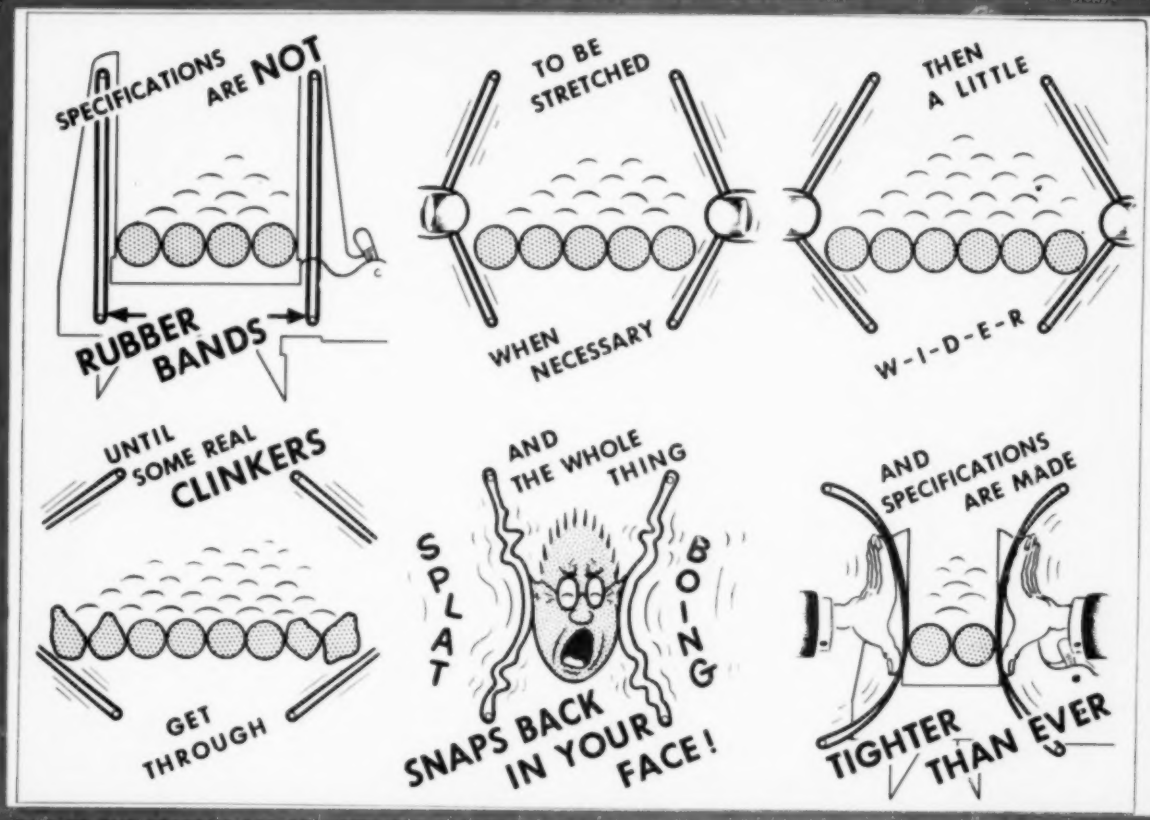
Industrial QUALITY CONTROL

SEPTEMBER, 1952 VOL. IX, NO. 2



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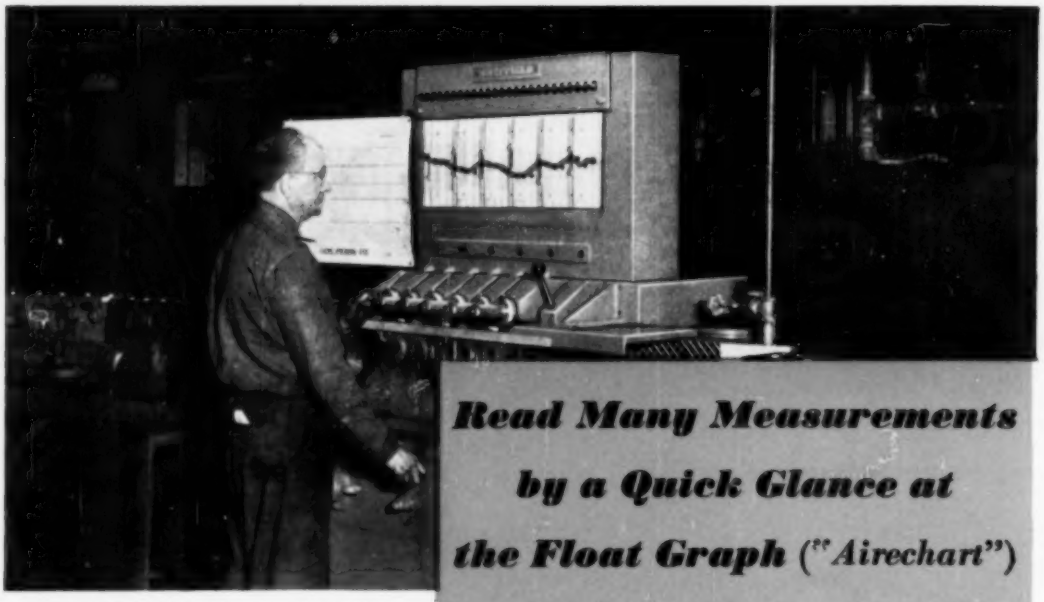

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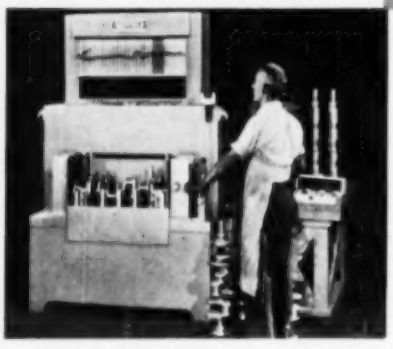
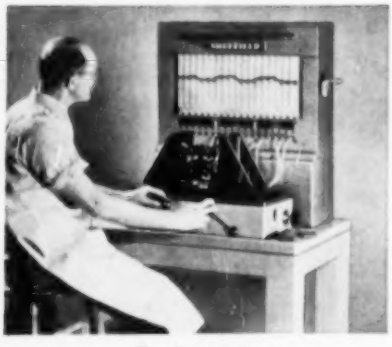


Checking 27 crankshaft measurements.



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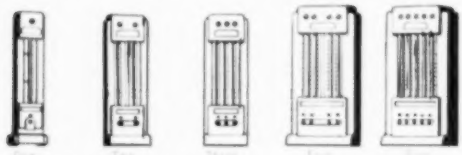

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Industrial Quality Control

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FOUR IMPORTANT ANNOUNCEMENTS

1. Your Editorial Chairman, Mason E. Wescott, is happy to report that he has accepted an appointment as Professor of Applied Statistics on the faculty of the Mathematics Department in the University College of Rutgers University, effective July 1, 1952. In this new assignment, he joins with Ellis Ott and other staff members of the State University of New Jersey in carrying forward the graduate program in statistical quality control and applied statistics offered by Rutgers. The new address of the Editorial Chairman's office is

Mason E. Wescott
Rutgers University
University College
New Brunswick, New Jersey

2. Your Editorial Chairman further reports that Rutgers University has granted him a leave of absence for the first semester of the 1952-53 academic year. This leave will be used for serving on a team of instructors commissioned by the Technical Assistance Administration of the United Nations at the request of the Indian Government to spend four months in India. Other members of the team are: Professors Ellis R. Ott, Rutgers University; Paul C. Clifford, Montclair State Teachers College; and Anders Hald, University of Copenhagen, Denmark. The purpose of the trip will be to offer courses in statistical quality control and to serve in a consulting capacity to industry and the government of India. The American members of the team are scheduled to leave New York City September 17 to be gone until about February 1, 1953.

3. During the period September 1, 1952, to February 15, 1953, Professor Irving W. Burr, Purdue University, will serve the Society as Acting Editorial Chairman. All correspondence relating to the submission and processing of manuscripts and general editorial copy for the November, January, and March issues of *Industrial Quality Control* should be directed to Professor Burr at the address:

Statistical Laboratory
Purdue University
Lafayette, Indiana

4. As of this issue, the Society now maintains a Managing Editor's office in Milwaukee, Wisconsin. Activities of this office are under the direction of Mr. George R. Foster, appointed to this post by the Society at its convention in Syracuse last May. Currently, the major responsibility of this office will consist of handling the preparation of copy, proof-reading, and make-up of IQC. As rapidly as seems feasible, responsibility for the News Supplement and for advertising will be placed under the Managing Editor. Correspondence relating to the work of this office should be addressed to:

George R. Foster
Industrial Quality Control
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Milwaukee 3, Wisconsin

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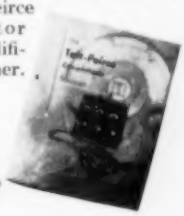

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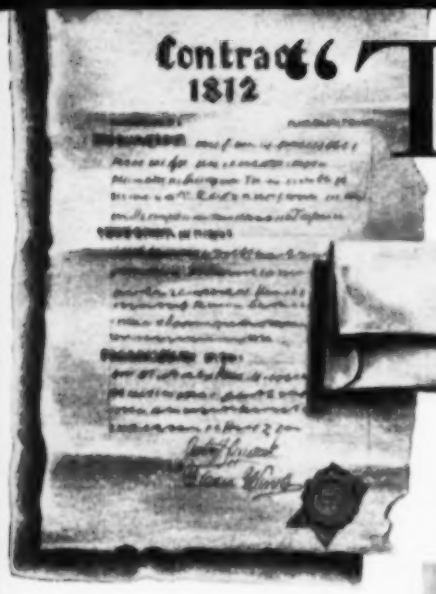

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The Extra Man in the Pilot Plant*

FRANK W. WEHRFRITZ

The Celotex Corporation

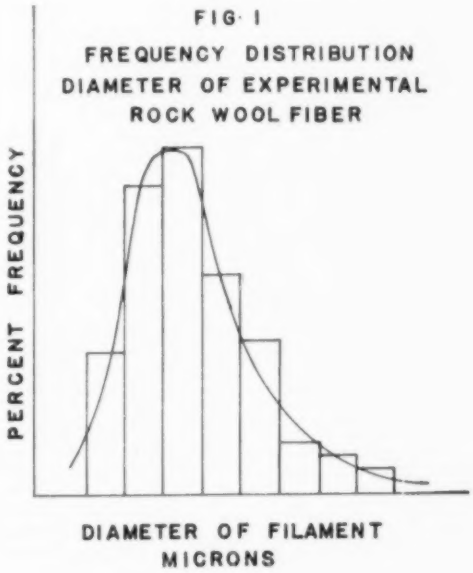
A COMPANY establishes a pilot plant for any one of several reasons. Consider the situation in basic research work when the beaker type or theoretical research is essentially complete and the company is now considering a large financial investment in a full scale process. The pilot plant enters the picture at this point as the place where a larger look can be taken at the chemical reaction or product which looked so promising in the laboratory stage. Consider another situation where the factory process is already established, possibly having been purchased or licensed from others, or perhaps it just grew into a business from a small beginning. The pilot plant is not the predecessor of the factory in this case. The pilot plant comes along later because decisions have to be made about new type equipment or alternate raw materials, and it is not a sound procedure to interrupt a going factory production group to do development or research work if it can be avoided. Regardless of how the pilot plant came into being, it is established for one major reason above many others—to answer questions about a wide variety of items relating to the larger scale process. Some of these questions and their answers will form the basis of this paper.

The extra man in the pilot plant is statistics. The dictionary defines statistics as the science that deals with the collection and tabulation of numerical facts. When we take a sample and calculate an average, we have calculated the first statistic of that sample. Other calculated quantities such as a standard deviation, or a correlation coefficient, or the equation describing a scatter of points are all statistics. The range of statistics is far greater than most of us realize. We are all acquainted with life insurance statistics, quality control, industrial accident statistics. Some of the newer applications of statistics deal with flutter in aircraft, the building times of prefabs, and the dating of the books of the Rigveda which contain sacred Hindu verses some 4000 years old. The numerical facts generated in these widely diverse fields are capable of being boiled down to a few simple statistics just as readily as those generated in a pilot plant.

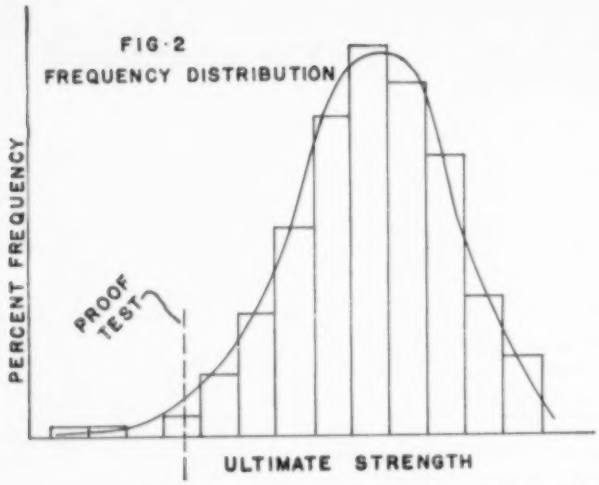
Let us consider an example from industry where a frequency distribution, which is another statistic, describes a situation far better than a lot of words. The example is taken from the home insulation field. You are probably all acquainted with rock wool, which is used extensively in home and industrial heat insulations. Figure 1 shows the frequency distribution of the diameters of the filaments of rock wool fiber made in a pilot plant experiment. The data are obtained by looking at a representative sample of the experimental wool under a microscope and counting the number of filaments in the various diameters.

The frequency distribution tells the story of what happened in the experimental run in so far as the diameter of the rock wool is concerned. The process average was about 5 microns. The spread of the distribution as measured by the standard deviation was 2.5 microns. One important thing that should be observed in connection with this distribution is its shape. The equipment for forming the rock wool is producing most of the filaments on the small side. A skewness factor can be calculated to show the actual lopsidedness of the distribution. Another important feature of this graphical picture is its indication of what to look for in the future because one of the functions of research work is to get some indication from the present experiment of behavior characteristics of future experiments performed along the same line. The research engineer in this experiment was looking for small diameter rock wool fibers. Future experiments required gener-

FIG. 1



*Presented at the Rutgers All-Day Quality Control Conference, Rutgers University, September, 1951.



ating an even more skewed distribution, pushing the average further to the left.

The average and standard deviation are the basic statistical tools in this problem. The graph of the frequency distribution pattern of the filament diameters is telling the story for the experiment in a concise manner because it is a picture of the result.

Another problem where statistical methods were particularly useful was concerned with a proof test. A proof test is one in which the commodity is subjected to a load which equals or exceeds the design or working load, but which does not test that commodity to the point of complete destruction. In the cement-asbestos industry, proof testing is made an almost automatic procedure in most cases since the testing equipment falls quite naturally into the production line. Any product which fails in the proof test is considered questionable material which might have brought a complaint from the customer. Therefore, a proof test improves the quality and the reputation of the product. The problem arose through the following circumstances. The research and development organization had pilot plant equipment installed several years after the process had become a going business. The crux of the problem was whether this equipment would produce results paralleling those which would have been obtained if we did our experimenting in the factory, as we had had to do before the pilot plant was made available. In other words, the factory proof tests its product, and a certain percent of the material does not pass the test. If we operate the pilot plant, will the loss or failure percent be the same as in the factory, or will the pilot plant values differ widely from the factory values?

The problem was solved by using the data accumulated in testing a large number of pieces made in the pilot plant to the point of complete destruction. A frequency distribution of ultimate strengths was then formed. The average strength and its standard deviation were also calculated. This is shown in Figure 2.

The area to the left of the proof test line (dotted) represents the percent failure which would have occurred if only the proof test had been applied. The results were very gratifying since the pilot plant data predicted a proof test loss of 3.66%. The actual factory data on the same material was 3.22%.

The initial question was answered in the affirmative. The pilot plant equipment will answer questions about the larger factory process.

The argument might be raised as to whether it was necessary to explore the whole distribution of ultimate strength when we were merely interested in comparing the area of the left hand tail below the proof level for research-made vs. factory-made material. The factory only generates that area as part of their routine proof testing, and research could have done the same without the expense of the destruction tests beyond the proof test level. The research pilot plant answer would have been exactly the same, and it would not have been necessary to break all the other test specimens. However, you get more for your money by doing the extra work. In this case, the shape of the distribution was not known. It was suspected that it should be skewed with a long tail to the left. This suspicion is well founded since the breaking strength of chain or of paper are slightly skewed also. These data then add to our basic knowledge about the process and the extra effort was well spent. Also, the average and standard deviation was not known except in terms of sample sizes of 10 to 20. The larger sample size taken in this experiment gave a more valid estimate of the average and standard deviation than had been previously available. A further and important fact has to be considered. The experimenter has only 3.66 chances in 100 of finding substandard material. One hundred measurements might not have revealed anything since the chance of finding a defect is small. Before anything at all can be said with any confidence about the tail ends of a distribution, it is usually necessary to make several hundred measurements.

One of the more usual circumstances in pilot plant experimentation is to make a run of material, take half of it and treat it one way, and take the other half and treat it a second way. After the results are determined, the development engineer raises the question of whether any improvement in the product was brought about by the change in procedure. That extra man, statistical methods, again enters the picture to help solve the problem. The data of Table 1 (coded) are taken from an experiment which is an example of this situation.

A portland cement building material was subjected to two different curing methods. Twenty specimens were prepared; ten of these were given the standard cure, and the other ten were given an experimental cure which it was felt would improve the strength of the product. The values in the table are the unit strengths of the material.

The average strength for the experimental cure is 24 units higher than that of the standard cure. Is it a real increase or one due to chance causes? The t-test enables us to compare these two averages, which is what it was devised to do. The

TABLE 1

	Standard Cure	Experimental Cure
	415	430
	425	390
	405	390
	390	405
	385	450
	390	440
	380	410
	370	450
	370	375
	390	420
Ave.	392	416

t-test does this, taking into account the obvious variability of the individual values. The method for calculating the value of t is given in many of the text books and will not be repeated here. For these data, a significant difference occurred between the two averages. The effect of the experimental cure cannot be attributed to chance causes.

There are certain experimental procedures which must be used in order to have a reliable basis for making a comparison such as in the curing experiment. Almost all of the more recent texts on statistics devote a page or two to a subject called randomization. The preceding problem is a good example of applying this concept. It would not have been a sound procedure to take the first ten experimental specimens for curing one way and the next ten for curing another way because an observed difference between the two groups might well have been due to the cyclic behavior of the production equipment. Quite frequently, machines which turn out individual units of production operate in cycles and the machine operator will speak in terms of the machine "leveling off". The selection of the twenty specimens for the curing experiment was therefore done by first allowing the machine to operate for an hour so as to eliminate a "start-up" effect which is important in dealing with portland cement products. The twenty specimens were taken and these were then divided into two groups of ten each, making sure that each group of ten did not contain too many consecutively made items. The testing of the product was also done in a random manner. Twenty specimens were submitted for test with only a coded identification rather than in two groups of ten each which might unknowingly create a bias in the testing machine operator. These precautions all help to create an unbiased environment through which the effects we are looking for have a chance to appear.

These three examples of applying statistical methods to pilot plant experimentation are among the simplest types which occur. The following is a more complicated arrangement. Four slightly different raw materials were available, and it was desired to examine a cement-asbestos building material made with each type. It was decided to repeat the four runs on four different days in order to pick up some day-to-day variability. It was also known that the equipment which had to be used had a "start-up" effect, and it was decided to incorporate this along with the other factors into the experiment. An experimental design

TABLE 2—**A 4 x 4 Latin square**

	Mon.	Tues.	Wed.	Thurs.
R1	1	2	3	4
R2	3	1	4	2
R3	4	3	2	1
R4	2	4	1	3

known as a 4 x 4 Latin square was used in this problem. The pattern for this experiment looks as follows. (The R's denote the raw materials, the numbers denote the order in which the material was run on the machine.)

The unique property of the Latin square is that the effects of the three variables (raw materials, days, order of operation) can be completely separated from each other. Whether the effect of the variable is a significant one depends upon the evidence found when that variable is weighed against the random or chance variation present in the experiment. The mathematical technique of weighing the evidence is done by one of the more powerful techniques of statistics known as the analysis of variance. This technique, for this problem, divides the total variation into four parts, that attributable to the raw material, to the days, to the order of operation, and a remainder called the experimental error variance or the residual variance (since it is usually calculated by difference). If the residual error is small compared to the variances of the other factors, then the factors are possibly significant. If, however, the residual error is large compared to the other factors, then the issue is clouded and we conclude that the factors have little significance on the result.

A pilot plant is called upon to solve, over a period of years, a variety of problems and in their solution eventually uses all of the common statistical techniques from the visual control charts through the more complicated experimental designs, with stops in between for t-tests, chi-square tests, correlation problems, and so on. Probably one of the major contributions to successful experimentation which mathematical statistics has made is to ask the experimenter to stop to think about the problem before starting to work on it. The concept of assessing the worth of a treatment or a factor by weighing it against the variation present in the measuring method is a sobering one, requiring adequate planning ahead of time. All of the information which the experiment is expected to yield must be built into the pattern of experimentation in the primary planning of the work. The extra man in the pilot plant is statistics and he is a valuable employee in the organization.

REMINDER

The Constitution of ASQC (Section 23) specifies that corporate members remaining in arrears after October 31 "shall receive no further Society publications".

Much confusion, delay in receiving IQC and its News Supplement, extra work and expense to the Society, etc. can be avoided if each member will

(1) make sure he has paid to his local Section officers his dues for 1951-52, and

(2) check with the officers of his local Section to make sure his membership and national dues have been transmitted to the Executive Secretary's office prior to October 31.

COVER PICTURE

We are indebted to Julian Toulouse, Owens-Illinois Glass Company, Toledo, for our September cover picture. Reproductions of this picture, with due source credit, may be made without formal request for copyright release.

The Hamilton Standard Reset-Run Card

DORIAN SHAININ

Chief Inspector, Hamilton Standard Division, United Aircraft Corporation.

PROFESSOR IRVING W. BURR of Purdue University presented "A New Method for Approving a Machine or Process Setting" in the January, September, and November 1949 issues of Industrial Quality Control. This use of sequential analysis for variables appealed to me. It seemed to have a useful application not only to automatic machine equipment but also, in a job lot type of shop, to the many resettings of a machine for more of a given job after it had been used for several other jobs. This paper proposes a modification of Professor Burr's work that may have some appeal. It achieves practicability with only small losses to the plan's original design features.

In the case of automatic equipment, the use of this method would support my contention that a control chart is generally not needed. After all, if the machine is in good operating condition and is truly automatic, the important thing is to know whether it is set correctly. The distribution curve of its product variation should be kept at such a location that the amount of defective material, if any, would be held to a minimum. This reasoning would apply in a practical way when past experience has indicated that, at least for the usual length of run, we do not expect to encounter any assignable cause of extra variation. Then, once such a machine is set correctly, it is logical to depend upon the automatic nature of the equipment as the means for keeping within control rather than resorting to the use of a control chart. We must recognize, of course, the possible effects of any known changes, such as the introduction of new stock, a change of lubricants, etc. Such changes may alter the results, so when they occur they should be followed by another machine setting check.

Professor Burr's series of three articles covered: (1) the method of trying to set at a precise level, as closely as possible; (2) how to check a setting close to one tolerance limit or the other, or to allow for in-process changes of setting when the specification limits are amply wide; (3) a simplification of the whole procedure by the presentation of sets of working tables. The situation I found at many plants encouraged a still further simplification of operating procedure in order to cope with the arithmetical abilities of the average machine operator and with the conditions under which he works. These involve oils or cutting fluids on his parts and hands that are not conducive to working with pencil and paper. Experience indicates that the simplification represented by the Reset-Run cards does not seriously detract from the effectiveness of the more complete presentation of the method that Professor Burr so clearly made.

The Reset-Run cards are a set of nine stiff paper forms, just small enough in width so that any spot on them can be reached with a ticket punch having a two-inch throat depth. The cards cover the needs of standard deviations in these units:

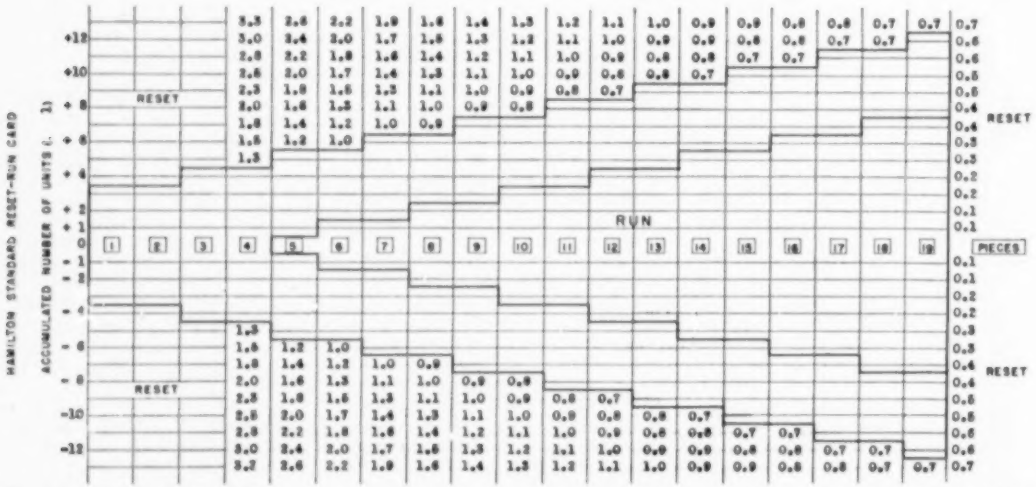


Figure 1—**The basic Reset-Run card for equipment having a standard deviation close to .010", .001", .0001" or the like.** The numbers on the other cards of the set are simply multiples of those on the basic card.

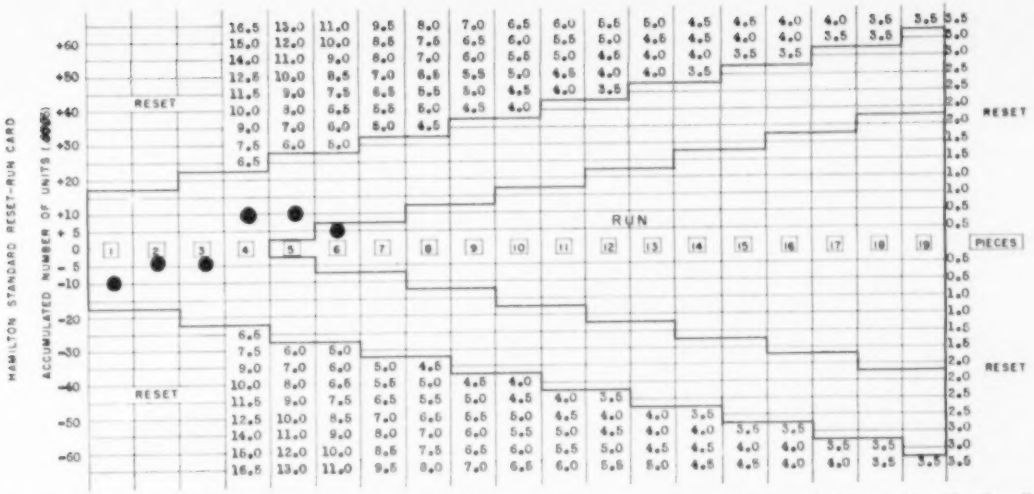


Figure 2—A satisfactory setting was indicated on this card by the successive ticket punch holes entering the "run" region after six pieces were measured. Keeping the intervals of measurement at the standard deviation value (.0005" in this case) results in sufficient sensitivity and adds to the simplicity of the arrangement of nine cards to handle all cases.

1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, and 8.0. For 10.0, we would use the card for 1.0, entering the decimal point in the proper place. Professor Burr's working tables used 12 intervals, each covering close to a 20% variation in standard deviation. I have had to accommodate a direct reading, non-computing procedure from gages that could result in a 10% to 25% "error" in standard deviation.

It is important to understand that to employ one of these cards the operator must have a gage with which he can classify each measurement to the nearest interval represented by the unit number of his card. Let us say, for example, that by checking the results of a previous run from a single spindle automatic, a standard deviation of the process in statistical control was .00021". We should then use the card of the set for two units, that being the closest to the standard deviation. Measure to the nearest .0002" intervals, using an indicator type gage that permits distinction between differences of this amount.

The following examples further show the rules for card selection. For an estimate of $\sigma' = .00124$, use card 1.0; for .00125, use 1.5. For .0090, use 1.0; for .0089, use 8.0. For .0035, use 4.0; for .0034, use 3.0.

The standard deviation of the process from a previous run is obtained from a conventional control chart that indicates a process controlled at least with respect to variability. To estimate σ', convert the average range, found from ten or more (preferably 20) subgroups, by dividing it by the constant d_2, or alter the standard deviation for averages (one-sixth of the distance between control limits for a standard chart for averages) by multiplying it by the square root of the sample or subgroup size.

The Reset-Run cards have been computed from the constants of Table 3 in Part I of Professor Burr's series in the January 1949 issue of IQC. We can therefore say that when the standard deviation of the process happens to agree exactly with the unit for which the card was printed, the operator has a 90% assurance that a machine setting, exactly at the dimensional size for which he has set the zero of his indicator, will result in a *run* decision. Similarly, if his actual machine setting is one standard deviation too high or too low, he is 90% sure that the card will result in a *reset* decision. It is, of course, possible to prepare cards for other levels of risk, but experience has shown that this 10% risk level is quite practical from an economical standpoint.

The method of using the cards simply involves these steps:

1. Furnish the operator with a batch of printed cards all for the same unit, say five, because his process standard deviation is somewhere between .000450" and .000549".
2. Give him an indicator type comparator gage that is marked in .0005" intervals, or has .001" marks that are amply wide so that he can readily estimate his measurements to the nearest .0005"*.
3. A master, or other standard, sets his comparator at zero for the desired process setting.
4. The first piece produced is measured and the result entered by punching out a hole in the left hand column of the card for piece No. 1. Note the column numbers for pieces in the small square boxes along the horizontal centerline of the card. He should punch the hole right on the line that, according to the left hand scale, represents the reading to the nearest .0005" found on his indicator. For example, if the reading were minus .0013", he would punch a hole on the line for minus 15. This is three lines below the zero on the card, since .0013" is

* Such indicator gages are no problem for cards 1.0, 2.0, 2.5, and 5.0. The markings on the standard dials can be easily read as so many of these intervals to correspond to so many lines on the Reset-Run card. For cards 1.5, 3.0, 4.0, 6.0 and 8.0, mark a blank dial or take advantage of this statement quoted from a leading indicator manufacturer's catalog, "Special graduations, having values other than the conventional divisions, can be supplied."

.0015" when corrected to the nearest .0005". The three lines stand for the three .0005's in .0015".

5. The reading from the second piece from the process goes into column No. 2. The number of lines the operator counts up or down corresponds again to a plus or minus reading of the number of .0005's in this measurement. Since we are interested in the accumulated or net algebraic sum of the readings, the operator must count these lines for the second piece marking as so many lines above or below the position of the first piece hole.
6. This procedure is continued until (1) at least four pieces are measured and (2) until a hole finally enters the center triangular shaped area marked "run", which is bounded by the stepped dark line, or (3) until a hole punches out one of the printed numbers. A punched-out number means that the machine should be reset that number of tenths of a thousand of an inch. That number estimates the amount the process is incorrectly set. A number punched out in the upper half of the card, of course, shows the process setting is too high, while one punched out in the lower half represents a setting that is too low.
7. If the process has thus been reset the amount indicated, the operator should immediately punch out a fresh card for the next few pieces produced. It will show whether he has successfully reset his process, or whether he has either under-corrected or over-corrected.

It is seen that the legend for the left hand scale of the card permits the operator to enter an appropriate number of zeros. The cards for five units, for example, can be used for standard deviations that are close to .0005", .005", .050", etc. The card for the unit one correspondingly can be used for standard deviations close to .0001", .001", .010", etc. The only difference between these two cards is (naturally) that all the numbers in the left hand vertical scale, as well as all the reset numbers are, on the card for 5, five times those on the card for one. Hence, the preparation of any one of the nine cards simply involves multiplying the numbers illustrated on the card for one by the appropriate card number.

Professor Burr's second article accommodated the case of a specification tolerance being eight or more times the process standard deviation. The machine setting decision could be reached after slightly fewer measurements than usual. There was a 90% assurance that the process setting was either too close to the one specification limit in question or that it was not too close. This modification permits the operator to allow for tool wear or the like and to start his process safely close to the limit from which the expected gradual change in process setting will move. Then, at an appropriate later time, a few more successive pieces will be measured about a second process setting. This one is the safe limit to which the gradual change can reach before it should be stopped. Here again, the operator can expect 90% of the time to get a decision to continue running if he has just reached this limit, and he is also 90% sure that he will be stopped if he has gone beyond this setting by one standard deviation.

Again I chose, in the interests of simplicity, against preparing a separate set of Reset-Run cards for these conditions of tool wear or for the other cases where the specifications tolerance is much larger than six standard deviations of the process. The same set of Reset-Run cards designed around indicating a setting that is one standard deviation too high or too low could be used effectively. The only change involved was what the results meant. For the tool wear case, the operator would use the zero setting on his indicator gage for the starting condition. The card would tell him whether he was within one standard

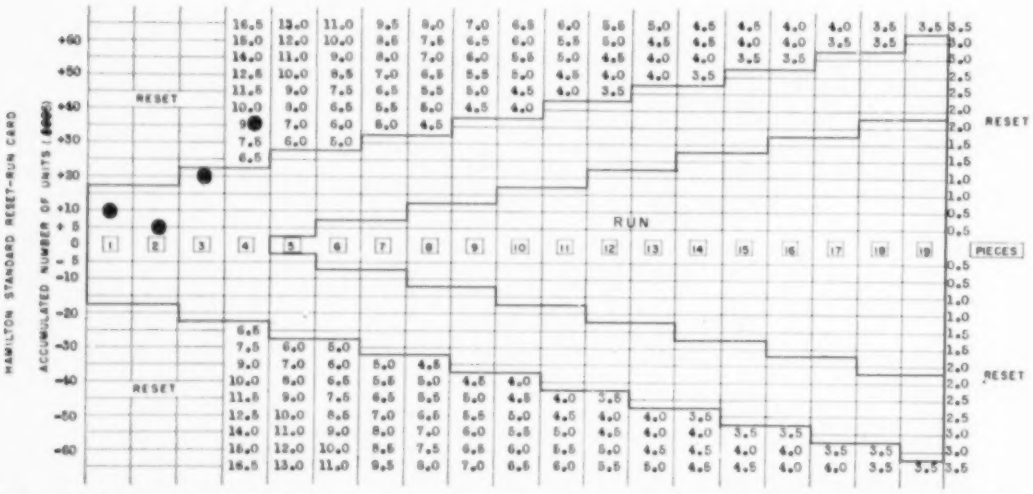
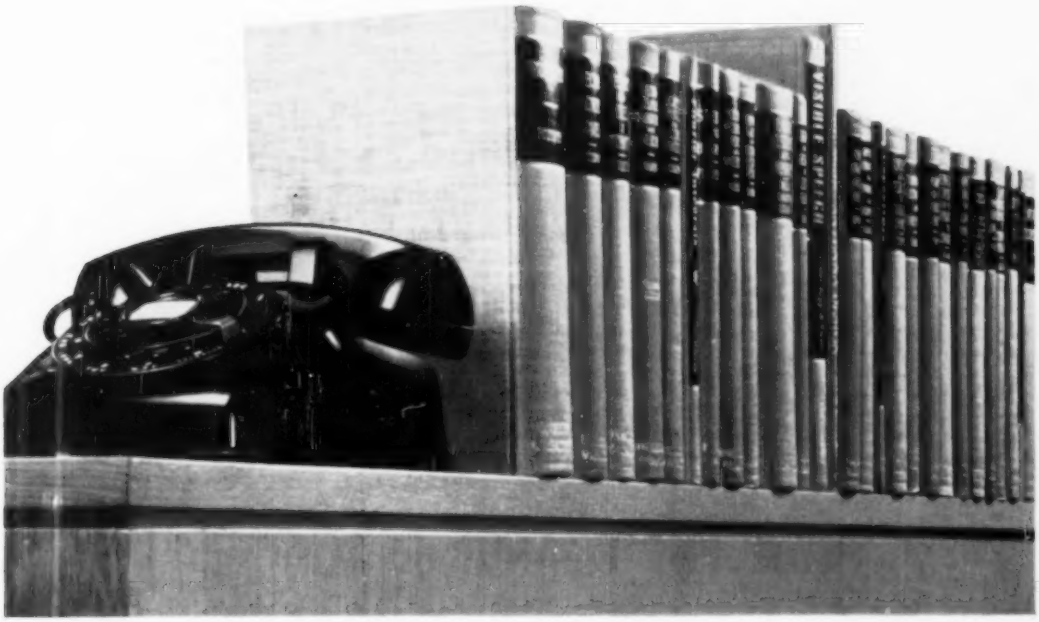


Figure 3—This process was producing work at a setting about .0009" too high (the number 9.0 was punched out after the 4th piece was measured). Reset decisions are not indicated until at least the accumulated readings of 4 pieces are available (for purposes of practical reliability), and a decision will always be indicated at least by the 20th piece.

Telephone Science Shares Its Knowledge



The Bell Telephone Laboratories Series of books is published by D. Van Nostrand Company. Other technical books by Laboratories authors have been published by John Wiley & Sons. Complete list of titles, authors and publishers may be obtained from Publication Dept., Bell Telephone Laboratories, New York 14.

List of Subjects: Speech and hearing, mathematics, transmission and switching circuits, networks and wave filters, quality control, transducers, servomechanisms, quartz crystals, capacitors, visible speech, earth conduction, radar, electron beams, microwaves, waveguides, traveling wave tubes, semiconductors, ferromagnetism.

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deviation of that setting. If he obtains a *reset* decision in the safe direction, the number he punches out would be the estimate of how far he is from the desired starting setting. This information permits him to decide whether to reset or to let the operation run. He will understand that he may have to reset or resharpen sooner than otherwise.

After the expected number of pieces for the tool wear shift has been produced, he punches out the second Reset-Run card, this time with his indicator set at the other extreme of his safe band. A *run* decision here would indicate he has probably reached this level; a *reset* decision in the dangerous direction indicates that he has exceeded this setting, and a *reset* decision in the safe direction indicates that he has not yet reached it.

In some plants a practical safe band is considered to extend from about $3\sigma'$ above the lower specification limit to $3\sigma'$ below the upper one. In such a case there may be a period of operation with a setting that can produce 2% to 3% defective material. A recommended compromise plan extends from close to $3\frac{1}{2}\sigma'$ above to $3\frac{1}{2}\sigma'$ below limits. Now an actual setting one σ' off, in an adverse direction, that can be approved 10% of the time, will produce about 0.5% defective material.

Another use for the Reset-Run card has been found with automatic size control equipment such as has been developed for external plain grinders. Many people have taken the stand that this sort of equipment eliminates the need for statistical quality control methods because a size control mechanism operates by measuring the piece as it is ground. It shuts off the machine just as soon as the desired size is reached. Then, since the piece itself controls its size, the effects of the variables inherent to the process are cancelled out and all the pieces come out alike.

This argument only *sounds* good. There is no question that such automatic size control devices **do** appreciably reduce the standard deviation of the results. But the industrial statistician can still claim successfully that it is impossible to make any two pieces exactly alike. If he has a fine enough measuring device he can bring out the frequency distribution of the variation inherent in the ability of the size control device to repeat. Its standard deviation can indicate the appropriate Reset-Run card to employ. The Reset-Run then shows whether the size control device is correctly set.

The above application is a useful one because very often the temperature and other conditions of the work while it is being ground out are not the same as those at the time the finished pieces are submitted to the inspection department. Under such conditions, it is wise to punch out a Reset-Run card just as soon as the work has reached a stable condition after it is taken out of the machine. Such a check will indicate whether the size control device should be arbitrarily set off a bit in one direction to compensate for the difference in these conditions.

One more obvious comment concerns the use of the Reset-Run cards for a multispindle automatic. The successive work from each spindle at the start of the run should be kept separate and punched out on a separate Reset-Run card. Watch for any differences between spindle settings.

A Study of Inspector Accuracy*

H. J. JACOBSON

Chief Inspector, Grand Sheet Metal Products Co.

NO CONTROL CHART can be any more accurate than the information on which it is compiled, so that the efficiency, or accuracy of the inspector is in all cases of prime consideration. It is well known that many inspectors are engaged in performing an inspection task for which they are not fully qualified, and this alone could result in considerable error in the final report. Although a margin of error is always taken into account when preparing a control chart, there is generally disagreement with the size of the error that should be allowed. It is conceded that inspectors will miss some defects, but a general consensus seems to be that Quality Control inspectors should miss no more than 5% on an average, because their work is not as repetitive as the ordinary inspection function. In other words a QC inspector is believed to be right from 95% to 98% of the time.

A few years ago a preliminary investigation with which the writer was associated was started to determine what might be expected in the way of inspector accuracy. However, merely observing inspectors at work, or occasionally verifying their results, did not give the information needed.

Accuracy in inspection results involves the placing of responsibility for determining conformance to requirements upon all grades of QC inspectors, and while the inspector's decisions are subject to review by his supervisor, he should be right an exceptionally high percentage of the time if he is to be of value to the organization. The accuracy and integrity of the QC inspector must be unquestioned. Non-reliance on his results would cause bad feeling on the part of the shop and inspection personnel as well as loss of prestige for the QC Department. Furthermore, preliminary studies had shown that control charts based on such an inspector's report would be untrustworthy.

SELECTING QC INSPECTORS

We know for example that the QC inspectors must be of a slightly different caliber than the regular line inspectors. They must have certain traits that will enable them to perform their job more efficiently. Just what these traits are, we were hard put to answer. For many years, it was felt, for example, that the educational level of QC inspectors

*The study reported in this paper represents a project started by the author and in which he participated while employed at the Hawthorne Plant of the Western Electric Co.

CHART I—Scoring Record on Second Selective Test

INSPECTOR	NUMBER OF DEFECTS FOUND												A	B	C	D	E
	20	19	18	17	16	15	14	13	12	11	10	9					
1	X												2	0	0	0	yes
2	X												0	0	0	2	yes
3	X												0	0	0	2	yes
4	X												1	0	0	6	yes
5		X											1	1	0	0	yes
6		X											1	0	1	1	yes
7		X											0	1	0	3	no
8		X											0	0	1	3	no
9		X											0	1	0	1	yes
10			X										2	0	2	0	yes
11			X										0	1	1	1	no
12			X										0	0	2	3	yes
13			X										1	1	1	0	yes
14			X										1	2	0	2	yes
15			X										0	0	2	1	yes
16			X										1	2	0	0	yes
17			X										0	2	0	2	yes
18			X										0	1	1	3	no
19				X									2	1	2	2	no
20				X									0	1	2	2	yes
21				X									1	1	2	2	yes
22				X									0	1	2	2	yes
23					X								2	2	2	2	no
24					X								1	4	0	0	yes
25					X								0	2	2	3	no
26					X								3	3	1	0	yes
27						X							0	5	0	1	yes
28						X							1	1	4	2	yes
29						X							0	1	4	3	no
30						X							0	2	3	1	yes
31							X						1	1	5	0	no
32							X						0	3	3	4	yes
33							X						0	3	3	0	no
34							X						0	4	2	4	no
35								X					1	3	4	4	yes
36								X					0	3	4	5	no
37								X					0	2	5	1	yes
38								X					2	4	3	1	yes
39												X	1	5	6	5	no
100%	4																
95%		5															
90%			9														
85%				4													
80%					4												
75%						4											
70%							4										
65%								4									
45%												1					

COLUMN A: "Defects" found by inspector but not put on the unit.

COLUMN B: Number of solderless connections missed by inspector.

COLUMN C: Number of insecurely soldered connections missed.

COLUMN D: Amount of damage done to unit by each inspector.

COLUMN E: Was correct technique used?

should be higher than that of the line or shop inspector. This resulted in hiring people with at least a two-year college education. Later results proved the fallacy of this thinking.

However, none of the thinking on this important phase of personnel hiring had ever been crystallized by us. No attempt had ever been made, at least in an analytical way, to put down the characteristics and temperaments, the intelligence, and adaptability of an individual who would make a good QC inspector, subject to the lowest rate of turnover.

Our method of hiring a QC inspector was no different from that of hiring a punch press operator or typist. The Employment Personnel Department gave a preliminary interview to a person who met the standards we had provided for him. These standards were of necessity only broad statements as to educational level and possibly personality traits, or job experience. Following this interview, the applicant was sent to the head of the Quality Control Department that had the job opening. He would also interview the individual, and if the qualifications seemed to be what were wanted, he would employ the man.

Although the above procedure seems to be a standard way to assure getting the right man for the job, it appeared after our study that the hiring of man was based mostly on personalities. If he hit the right note with our personnel men and the QC head, he was employed. This did not give us any clue, however, to the man's capabilities, and we did not know enough of his temperament to know if he would be happy on his job. The latter was important because we wanted him to stay on the job if he made good.

The position of the Quality Control Division in the company was such that it was independent from either the Manufacturing or Engineering Divisions. It could be said that we were acting for the customer in the acceptance or rejection of material.

Our quality inspectors had to be not only good inspectors, but diplomats as well, especially when rejecting a large amount of product to the shop to be reworked. Our requests for corrective action with regard to defective product had to be reasonable as well as accurate, and there could be no hint of dishonesty in the methods employed in our inspection.

CHART II—**Individual Performance in Order of Appearance**

The QC inspectors were graded in accordance with the type of work they performed. Responsibility within the grades varied, with more responsibility in the higher grades. In general, the inspectors in all of the grades were constantly in contact with supervision in the shop and inspection departments with regard to defects found on their respective jobs.

DEVELOPMENT OF A SELECTIVE TEST

Our first indication of anything wrong was when we began the system of revolving men on the different jobs. "Why," we asked, "did this product show a low percent of defects for one man, and a high percent for another?" Not too much effect was shown in the over-all picture of the product, but here and there evidence of irrationality came to light. Our first concern was, of course, the percent of accuracy of our inspectors. If we knew that, we could then apply some sort of weighting factor to compensate for any error. In our discussion of this problem with the shop inspection and inspection engineering organization, we were told that they expected their help to be about 95% accurate on moderately repetitive jobs. They assumed that all of their people were, although no test for this arbitrary figure had ever been made.

In a test, such as we had in mind, we then felt that our people should be at least 95% accurate, since our people generally ranked higher than the shop inspector, and our work was less repetitive. We were not too much concerned with a 5% error, although many of us felt that it would not amount to more than 2% or 3%, and this amount of error in our inspection was already a factor in rating the product.

Since one of the most critical defects we had to contend with was that of loose solder connections, we had placed an extremely low expectancy on the appearance of this defect. Anything greater than one loose connection in 10,000 was considered non-conforming (this is on a sampling basis) and the product was returned to the shop for re-inspection. One or two defects of this kind on a unit were enough to cause a scurry of activity through the shop, checking almost every unit on the floor. Because imperfect solder connections are so critical, it was decided that this item should be used as a guinea pig in an experiment to test our employees' accuracy. To make the test more difficult, other wiring defects were added.

A small wired unit was built, somewhat standard in appearance and equipment with the type of units inspected daily. The unit had approximately 1500 wires soldered to terminals. Thirty defects were placed throughout the unit in soldering, wiring, appearance items, and so forth, and 17 of our top grade inspectors were given three hours each to find as many of the defects as they could.

After each inspection, the unit was rechecked to assure that more de-

fects had not been made or that the defects present were not disturbed a sufficient amount to make them too obvious. Sixteen of the thirty defects on the unit were solder defects that were expected to be found almost 100% by the inspector. The other wiring defects entailed a knowledge of the wiring requirements that we felt not all of the men might have.

The results on the solder inspection showed an accuracy of 80.5% out of a possible 100%, and were quite disappointing. However, the results on the over-all test were even more surprising, with a low of 32% and a high of 65% of defects found!

Our first thought on viewing these results was, of course, training. We instituted weekly sessions on wiring and soldering immediately, and began covering the field thoroughly.

THE SECOND SELECTIVE TEST

Since the results of this test showed such low scoring, it was felt that the test may not have been fair or accurate, and it was decided to run another test to verify or disprove the first results. This test was to cover soldering defects only.

A small wired unit was built consisting of various items of equipment normally used in our standard product. There were 1000 soldered connections to terminal ends of the wired side of the unit. A total of 20 defects were made on the unit. Ten defects were wires which had been wrapped around a terminal but had not been soldered; these are known as "No Solders." Ten other defects were wires that had been poorly soldered so that they were insecure or loose connections that could be determined by a movement of the wire in the solder joint if the correct solder inspection technique was used. The unit was then lettered and numbered to facilitate locating the defects.

Thirty-nine people were given this test. Each person was allowed 1½ hours to inspect the unit and prepare his report. This amount of time was based on the average inspection time in daily use required to inspect soldered connections. A small amount of time was added to the allowable limit as a safety factor, and additional time for preparing the report. The inspector was provided with a standard work bench area, good lighting, and he was free of disturbance. Two types of inspection lamps were provided that were in use in the shops. Special report blanks were made up to make reporting of the defects easier and to cut down the length of time needed to make out the report. The timing of the inspector and the collection of the report was made by a disinterested party who knew none of the inspectors involved. Between each inspection, one-half hour was spent in verifying all of the reported defects, resoldering broken wires, and re-arranging the dressing of the wires that had been disturbed. When the defects on the unit were disturbed to a degree where they became obvious, they were re-wired to their original conditions.

The 39 people that took the test included all grades of inspectors. Fourteen of the inspectors that took the first test were in this group.

Chart I shows the method of scoring. Column "A" lists the number of defects found in addition to those put on the unit. Some of these "defects" are erroneous; others were caused by damage to the unit by the previous inspector. Column "B" lists the number of the solderless connections the inspector missed. Column "C" lists the number of "Insecure Solders" missed; Column "D" lists the amount of damage done to the unit by each individual and indicates with Column "E" if the inspector used the correct technique in his inspection.

The comparison of the number of soldering defects found was favorable. Assuming that an efficient inspector would find 95% of the defects and would be considered 95% efficient, the second test showed an efficiency of 83% compared with 80% on the first test. A summary of Chart I follows:

4 found 20 or 100%
5 found 19 or 95%
9 found 18 or 90%
4 found 17 or 85%
4 found 16 or 80%
4 found 15 or 75%
4 found 14 or 70%
4 found 13 or 65%
1 found 9 or 45%

COMPARISON OF THE TESTS

This test seemed to bear out the results of our first test and comparison was made between the two with the fourteen people who had taken both. The comparison showed the following:

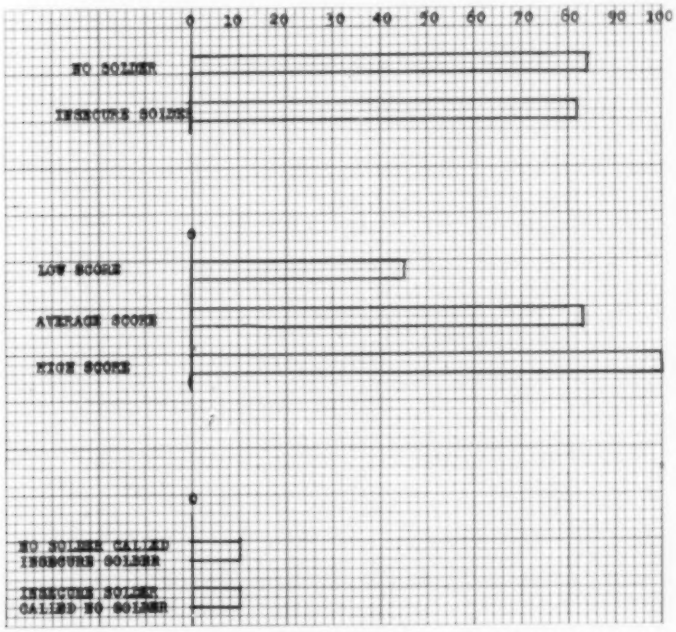

CHART III—**Percent of Accuracy**

	Man	1st Test	2nd Test
Group 1	A	89%	85%
	B	97%	100%
	C	100%	85%
	D	94%	90%
	E	83%	95%
	F	80%	95%
	G	100%	90%
Group 2	H	63%	75%
	I	52%	80%
	J	60%	80%
	K	69%	80%
	L	49%	70%
Group 3	M	52%	85%
	N	91%	65%

The first test had incorporated defects other than soldering so that, in order to establish an equitable comparison between the first and second test, we used the results of the first test relating to soldering only. For both tests, a score of 85% or better was considered acceptable performance for these tests.

Group 1—Acceptable performance All seven inspectors with over 80% on the first test got 85% or better on the second.

Group 2—In both first and second tests the scores of the individuals were lower than we would consider acceptable performance.

Group 3—Inspector M was not as familiar with wiring defects as he was with solder inspection and so wasted much time on the first test with a consequent low score. Inspector N did not complete his second test in the allotted time.

Chart II shows the individual accuracy of the inspectors as they were selected at random to work on the test unit, in comparison with what we had set as a standard. Since we had originally considered that an inspector should have an accuracy rating of 95%, we set an upper limit of 100%, representing all 20 defects to be found by an inspector, and a lower limit of 18, or 90%. Only 18 of the 39 inspectors produced results within these limits. Based on these figures, only 46%, or less than half, of our inspection force was performing its job within the expected accuracy.

In order that we might determine if one type of defect was harder for

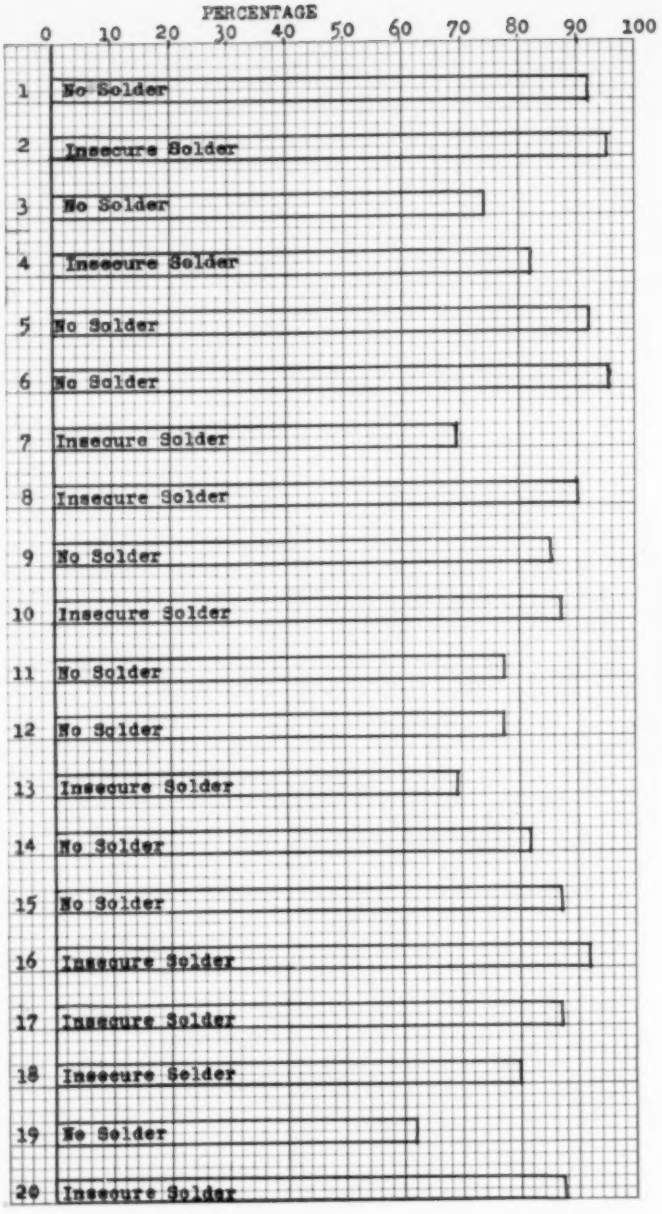

CHART IV—**Relative Frequency of Discovery of Defects by Inspectors**

Each bar represents one defect on the unit in the order of its appearance on the unit. The percentages are the percent of the inspectors that found that defect. For example, 74% of the inspectors found and reported defect No. 3.

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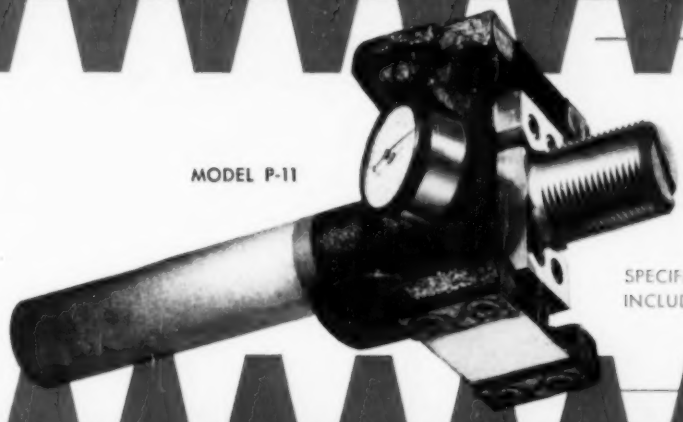

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an inspector to find than another, we compared the results of our test on the two types of defects placed on the unit. Chart III shows practically no difference in finding either type of defect, and records a low score of 45%, an average of 83%, and a high of 100%. In some cases the inspector called a No Solder an Insecure Solder. He was given credit for finding a defect regardless of what he called it, and it is seen that this was done the same number of times for each defect.

In fairness to the inspectors, we wished to determine if all of the defects were equally discernible, or if one defect was hidden more than another. Chart IV shows the percent of times the 39 inspectors found each defect.

The numbers from one to 20 on the chart represent the appearance of each defect on the unit. For example, Defect #1 was found by 92% of the inspectors while Defect #19 was found by only 62%. The fact that no one defect was found by all inspectors or that no defect was missed by a majority of inspectors was an indication that the defects placed on the unit were a fair representation of the defects found in the product.

Since the ages of our inspectors varied greatly, we thought we should compare accuracy with age groups, to determine if possible whether the age of an inspector was a factor in his accuracy. Chart V shows these averages and their relation to the age groups. The number of people in each age group is shown at the bottom of the chart.

IMPORTANCE OF VISUAL ACUITY

Of course, one of the first things we thought of as a possible reason for the low efficiency was simply, "How well could these men see? What was the condition of their eyes, and how did their vision compare with their score of defects?"

All 39 inspectors were immediately scheduled for eye examinations. They were tested on the Ortho-Rater, a commercial type of eye test that measures eye efficiency against a standard but makes no opthalmic rating. Here it was found that of the 21 people who made a score of less than 90 on the second test, eight had below standard vision and they were referred to our company's optical department; only six had acceptable vision.

Of the 18 who had scored 90 or better, 12 had exceptional vision, three were acceptable, and two were below standard. Of the 12 who had exceptional vision it was noted that the four inspectors who scored 100 on the test were in this group. Of the two below standard, one had a maximum correction in his glasses that would influence the test, while the other had a near-sighted condition that would not too greatly influence his ability to see things closely. (See Chart VI.)

As a result of these tests, all of the people found below standard in vision were tested by our optical department, and prescription safety glasses were ordered for them, or they were asked to see their own doctor for prescription glasses. The relation between the visual findings and that of our two tests was very clear and convinced us that eye tests for our entire Quality Control Division would be in order.

Of course, many of our people already wore glasses. Some, however had not had their eyes rechecked for a number of years. A total of 130 of our people were given the test. These included clerical help as well as inspection personnel. The results were as follows:

Average or above average vision for inspection work: 98, or 75%

Below average vision for inspection work: 32, or 25%

While the 25% below average seemed a rather high percentage, it was found that 27 of the 32 people below average were believed capable of improvement through optical aid, either by changes in the prescription of the glasses they were wearing, or through prescription of new glasses where none were worn. The result

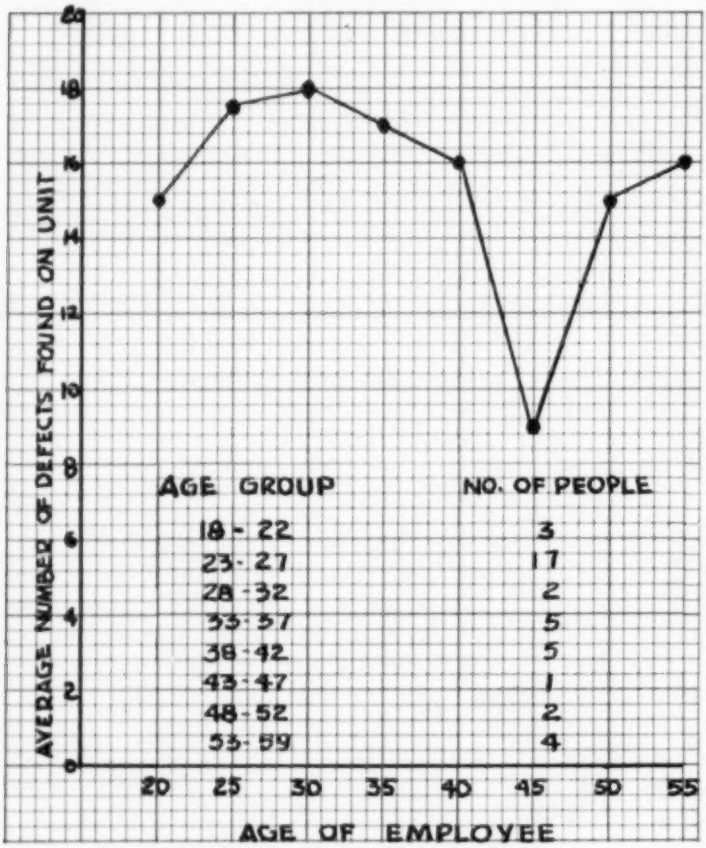

CHART V—**Distribution of Inspectors by Age**

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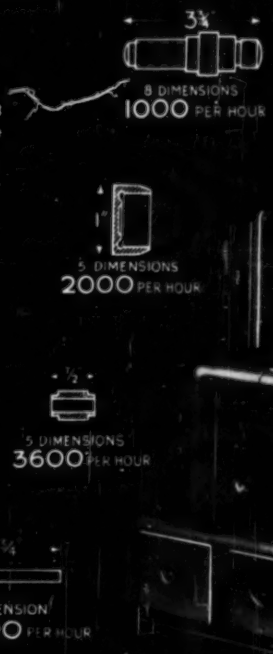

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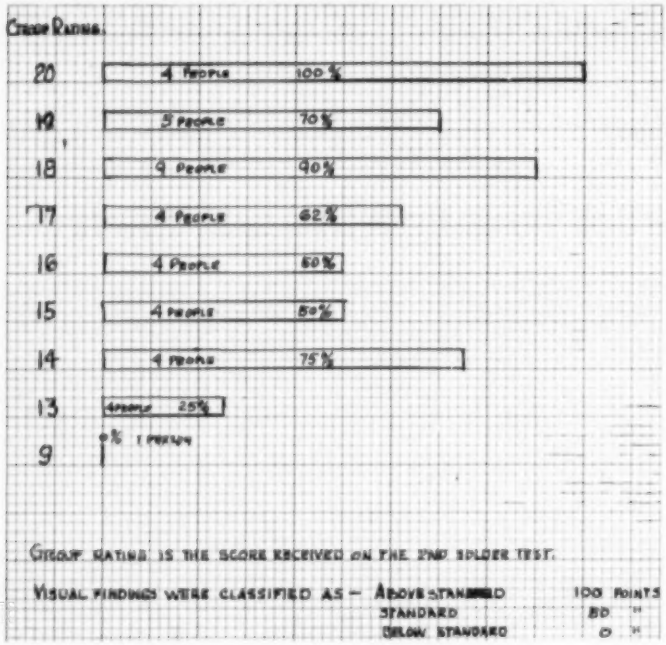

CHART VI—**Visual Acuity and Test Rating**

was that 23 of the 27 had new prescription glasses made, and when again tested, passed the Visual Acuity Test as acceptable or better. Other factors which would decrease this percentage somewhat were that five of these people were clerical help.

The results shown by this study prompted us to set up an agreement with the personnel people that in the future, all people employed by our Division would be given a Visual Acuity Test before hiring. In addition, it was arranged to have all of our people rechecked for vision once each year.

OTHER QUALITIES OF QC INSPECTORS

While we had found during this part of our survey that some physical characteristics such as vision would seriously affect an inspector's ability to perform a good job, we realized that many other factors had a part in the way he fit in with our program. Important among these were intelligence, dexterity, temperament, job preference, job knowledge, and personality. The problem of selection of personnel by testing methods was discussed in some detail with a psychological testing and research group. Our first step in this study was to provide the testing group with our most recent inspector ratings to use as a comparison with the findings of the psychological tests.

This rating sheet measured 15 characteristics in five levels for each characteristic. Rating was done by the immediate supervisor. The characteristics measured were as follows:

1. Quality of work
2. Quantity of work
3. Knowledge of job
4. Accuracy in carrying out orders or assignments
5. Acceptance of responsibility
6. Attitude toward work
7. Ability to learn
8. Ability to get along with other employees
9. Loyalty to company
10. Safety habits
11. Ability to think and reason clearly
12. Promotional possibility
13. Manner and appearance
14. Impression made on others
15. Self control under pressure

A set of tests was set up of a type that we felt would most clearly indicate the type of personnel we required. The tests used were as follows:

Industrial Training Classification Test, Purdue—Form B
Kuder Preference Record—Form BB
Guilford-Martin Personality Inventory 1
Minnesota Paper Form Board Test, Series BB

Results of these tests showed good agreement between the Supervisor's Rating and the Inspector's test. In some cases the agreement was surprisingly strong, which indicated clearly that the tests would show the necessary characteristics with a high degree of accuracy.

As a final analysis, action was taken to study the accuracy of the testing and its reliability by submitting new employees to the tests and relating our experience with them to our original test results. This was a long drawn out procedure involving several years for the proper comparisons. It will eventually pay off in a better method of selecting personnel for the Quality Control Department.

SUBSEQUENT EXPERIENCE

After leaving the Western Electric Company where this study was made, I became associated with the Grand Sheet Metal Products Company. Here it was necessary for me to set up a completely new Inspection and Quality Control Department. In doing so, I experimented with one of the tests used in our original study. This is the Industrial Training Classification Test, published by Science Research Associates of Chicago. It is quickly given and easily scored and clearly establishes a good picture of the applicant's knowledge of measurement and elementary mathematics. I have found it very helpful in selecting an employee for our inspection department. Unfortunately I have not been able to use the various Personality Tests, since these are supplied only to firms having staff psychologists.

All applicants for Inspection of Quality Control at Grand Sheet Metal are examined for Visual Acuity, and in all cases applicants failing to meet the standards of this test are rejected. The tests are applied by a competent optometrist and cover the following factors:

1st and 2nd degree fusion
Vertical and lateral pharios
Distance acuity—near and far
Color blindness
1st and 2nd degree steriopsis

Hand and eye coordination
Spatial projection—near and far

We have found the Visual Acuity Test a necessary aid in our selection of personnel. It is our experience that any such aids which are scientific and which can be used in this selection will give far better results than methods previously used.

Practical Aids

ELLIS R. OTT, Editor

Send your "Practical Aid" contribution to:
Dr. Ellis R. Ott
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A Sensitive and Flexible Control of the Percentage Defective

FRANK E. SATTERTHWAITE
General Electric Company

MANY processes are subject to wide variations in the percentage defective. The standard "p" or "c" types of control charts are not completely satisfactory in such cases. Cumulative charts are quite effective in these applications. An *exposure ratio test* is proposed as a convenient and sensitive method for checking the significance of apparent changes in the defect rate.

THE CUMULATIVE CHART

Let us consider a specific example of molding a white plastic refrigerator part where dirt contamination is a serious problem. The cycle number where a defect occurs is recorded as in the following example:

Defect Number	Cycle Number	Defect Number	Cycle Number
0	435	10	742
1	480	11	768
2	496	12	775
3	538	13	777
4	549	14	782
5	583	15	803
6	640	16	805
7	701	17	807
8	715	18	810
9	730	19	816

The defect numbers are preprinted on the record sheet and the machine cycle numbers are taken from an automatic counter on the machine. Thus there is very little work for the operator to keep this record.

As a general rule, however, we find that control records calling for action are more effective if in graphical form. This case is no exception. From Chart I it is clear that the percentage of defects started to increase about cycle 700. At about cycle 800 a further sharp increase occurred. In this example, the change can be detected without recourse to any "control limits."

Charts of this type are called *cumulative charts*. They are ideal whenever a continuous record is desirable. Many 100 percent inspection operations performed close to the manufacturing operation are in this class.

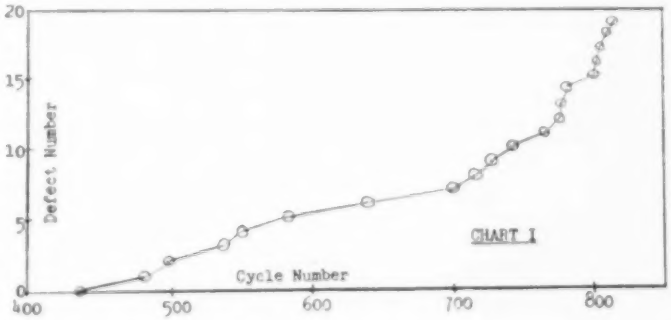
The installation of this type of chart on a punch press operation, where defects cost $2.00 each, saved $40,000 per year. The results were practically instantaneous, being realized in the first 24 hours. Naturally production increased at the same time.

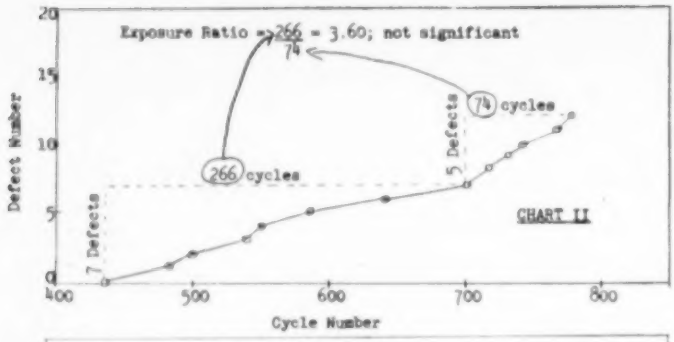
THE EXPOSURE RATIO TEST FOR SIGNIFICANCE

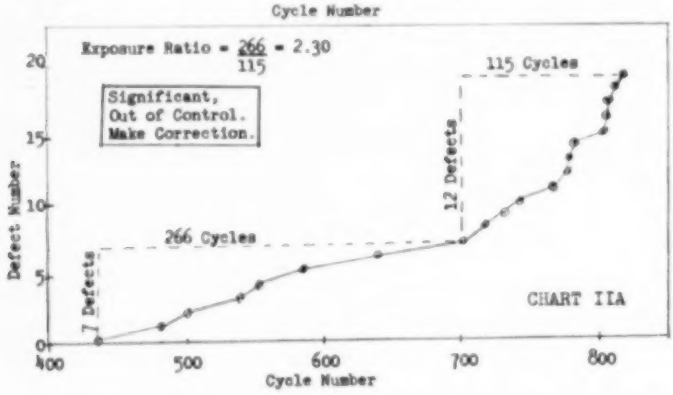
While for many processes changes in the percentage of defects are so large that results are obvious, in other cases it is worthwhile to pick up a small change just as rapidly as possible. This is particularly true when defects are expensive and occur only a few times a day or week or month. In these cases one needs a significance test or control limits to detect the change in the percentage of defects just as quickly as enough data accumulates to prove that the change is real and is not chance.

The exposure ratio test is a convenient test in connection with cumulative charts. In plotting the chart, one probably would have become suspicious about the time he posted defect number 12.

Chart II demonstrates the method of calculating the exposure ratio. The number of defects and the number of cycles is marked off for each of the periods to be checked. The exposure ratio is defined to be the ratio of the number of cycles. Table 1 gives the 0.5-percent significance levels for this exposure ratio. On







line 5 in column 7, we find the critical value is 8.80. Since we obtained only 3.60 from Chart II, we do not have evidence (at the 0.5-percent level) of a significant change in the process. Corrective action is not yet called for.

However, the apparent increase in defects continued and a further check might be made about defect number 19 (see Chart IIA). In column 7, interpolation for line 12 gives a critical value of the exposure ratio of 2.3. Thus the change in the percentage of defects is just significant at the 0.5-percent level. A change as large as this would occur by chance only once in 200 times. We can conclude with 99.5 percent confidence that this high defect rate will continue into the future unless we do something about it. We are out of control. Take corrective action.

MULTIPLE TYPES OF DEFECTS

Usually an inspection uncovers several types of defects. Chart III shows a typical example where there are four types of defects. Code numbers have been placed beside each plotted point on the chart.

It is seen that about defect number 12, a sharp increase occurred in the rate of defects. Moreover, it is seen that this increase is made up predominantly of type 1 which had not occurred previously. Therefore, this defect is plotted separately at the bottom of the chart. The exposure ratio test gives

1 defect in 3200 cycles
3 defects in 320 cycles
Exposure ratio = 3200/320 = 10

Line 3 and column 1 of Table 1 give the critical value of 8.10, indicating that there has been a significant increase in the number of cracked

TABLE 1—**Exposure Ratio, E**
Largest Values Which Occur by Chance—0.5% Significance Level

Number of Defects for Denominator (higher % of Defects)	Number of Defects for Numerator (lower % of Defects)													
	0	1	2	3	4	5	6	7	8	9	10	15	20	25
1	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	3200	4200	5200
2	13	23	32	44	55	66	77	88	99	109	119	161	205	253
3	4.8	8.1	11.3	14	17	20	23	26	29	32	35	52	68	85
4	2.7	4.3	5.9	7.5	9.1	10.7	12.3	14	16	17	19	26	33	41
5	1.9	3.0	4.0	5.0	6.0	7.0	7.9	8.8	9.7	10.6	11.6	16	21	26
6	1.4	2.2	2.9	3.5	4.2	4.9	5.7	6.4	7.1	7.8	8.5	12.1	16	19
7	1.1	1.7	2.2	2.8	3.3	3.8	4.3	4.8	5.3	5.9	6.4	8.9	12	15
8	.94	1.4	1.8	2.2	2.6	3.0	3.4	3.9	4.3	4.7	5.1	7.1	9.2	11
9	.80	1.2	1.5	1.9	2.2	2.6	2.9	3.3	3.6	4.0	4.3	5.9	7.5	9.1
10	.70	1.0	1.4	1.7	1.9	2.2	2.5	2.8	3.1	3.4	3.7	5.0	6.4	7.7
15	.42	.59	.76	.93	1.1	1.3	1.4	1.6	1.7	1.9	2.0	2.7	3.4	4.2
20	.30	.42	.55	.67	.78	.89	1.0	1.1	1.2	1.3	1.4	1.9	2.4	3.0
25	.24	.33	.42	.51	.60	.68	.76	.84	.92	1.0	1.1	1.5	1.8	2.2

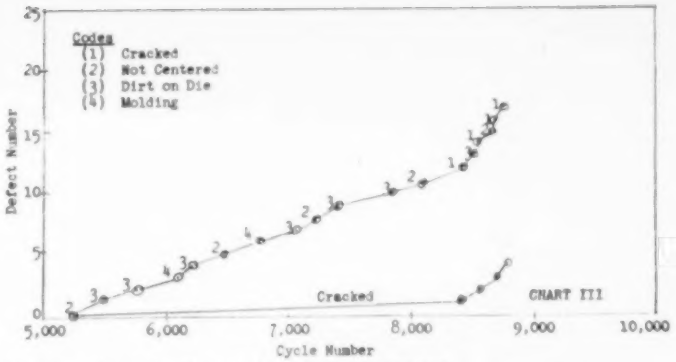
Calculated from the Incomplete Beta Function as charted by Simon, Leslie E.; *An Engineer's Manual of Statistical Methods*; John Wiley & Sons; New York; 1941.

panels. We are out of control. A check of the die indicated the need of sharpening.

It is instructive to check the exposure ratio for the total defects.

12 defects in 3200 cycles
5 defects in 320 cycles
Exposure ratio = 3200/320 = 10

Line 5 of column 12 of Table 1 gives the critical value of the exposure ratio as 12.7. Thus the change is not significant. We are still in control. The check on a single type of defect is a more sensitive test than the check on the total of several types.



SUMMARY

Cumulative charts are generally the most effective method for plotting 100-percent inspection data. Changes in the defect rate are often obvious and no significance test on control limits are necessary.

When a significance test is desirable, the *exposure ratio* test is most convenient.

These methods are easily applied where a number of different defect types are involved.

Book Reviews

A. C. Cohen, Jr., *Editor*

Correspondence and suggestions concerning book reviews should be sent to:
Professor A. C. Cohen, Jr.
Department of Mathematics
University of Georgia
Athens, Ga.

EFFECTIVE MANAGEMENT THROUGH PROBABILITY CONTROLS

Robert Kirk Mueller; Funk and Wagnalls Company, New York, 1950. 310 + xvi pages; $5.00. Review by John H. Reynolds, Celanese Corporation of America, Rome, Georgia.

The subtitle of this book is "How to Calculate Managerial Risks." It is hoped that this will not frighten away the executive who rightly thinks that computation can be relegated to technical staff members. The book is not intended to tell one how to do computations. It, as the author says, ". . . . does not belong on the shelf beside authoritative volumes on the science of statistics or statistical methodology but is intended to spur the imagination of management personnel to consider using statistical control in their business, if it has not already been used, and, if it has been started as statistical quality control alone, to extend applications of these methods into more administrative phases". The book does two things in addition to inspiring the executive. It presents a well organized and authoritative over-all survey of the application of probability statistical techniques from a practical management point of view. It also tells the executive how he can use a statistical control program in his own organization, giving him many important helps for introducing the technique, selling it to top management, supervision, wage employees, suppliers and customers, and administrating the program once it is started.

The book is divided into five sections. Section I, "How to Make the Most of the Significant" serves as an introduction. In it, Mr. Mueller explains why statistics is needed in business, and why statistics is needed to help point out the significant among the multitude of modern business facts and relationships.

Section II, "Why Executives Are Interested in Statistical Probability," explains that executives are interested in statistical controls because they bring a high return on investment, and how they do this by saving valuable managerial time, and by pointing out the significant. Several specific cases are cited to illustrate. For example, the case of Electric Steels, Limited, in Cap de la Madeleine, Quebec is described where $300,000 were saved for an expenditure of $15,000 on foundry operations.

In Section III, "Brass Hat Facts about Statistical Control," Mr. Mueller gives just that. He tells just what it can do and what it cannot do. He describes the methods of statistical control in non-technical language and puts it in familiar settings so that the supposed mystery surrounding mathematics is removed. This is accomplished by many examples of the actual application of the methods in well known organizations.

Section IV, "But My Business is Different," amply answers this rather universal response of an executive when he first learns of successful applications in other businesses. It is explained that quality is a common denominator of business and industry and that maximum quality at minimum cost is "good business" any time, anywhere. Again many illustrations of the use of statistical control techniques are given for such divers applications, to name a few, as: in a mail order company, in selection of personnel, in verifying clerical work, in accident prevention work, in sales work, in time study, in engineering design, and in control of labor costs. But there are times and places where statistical control should not be used, and these are pointed out too.

Section V, "Topside Responsibility and Participation in a Control Program," explains how successful programs have been organized, how long a time is required to get results, how to select personnel to administer the program, how to tell whether a consultant is qualified, how to sell statistical control programs, where to find out more about statistical control, and how to read a control chart.

Many references are given throughout the book to other books and articles on statistical control methodology and administration. Aside from Mr. Mueller's own considerable contribution to managerial science, the book is of especial value for the selection and collection of those references to other material which help in using statistical control.

The style of the writer is quite readable, flows along nicely, and the occasional whimsy is most welcome. Mr. Mueller has done a nice job of writing about a technical subject in the practical executive's language.

Being a technical staff member, this is certainly one book which I will urge my boss to read. Not only would reading it help him, but it would make my job ever so much easier.

STATISTICAL METHODOLOGY REVIEWS 1941-1950

Edited by Oscar Krisen Buros; John Wiley and Sons, Inc., New York, 1951. pp. 457. $7.00. Review by A. C. Cohen, Jr., University of Georgia.

This volume references significant books and papers published in the field of statistical methodology during the decade 1941 to 1950. It includes excerpts from eight hundred and forty-two reviews of papers gleaned from one hundred and twelve different journals. In addition, it contains capsule summaries and evaluations of three hundred and forty-two books written in English which were published or reviewed during the period covered. Countries of publications include Australia, Canada, Denmark, Holland, India, Puerto Rico, Scotland, South Africa, Sweden, Switzerland and the United States. Many of the books and papers referenced are concerned directly with topics of Statistical Quality Control. An index of names which includes both authors and reviewers, an index of titles, and a classified index of books have been provided.

Anyone who has occasion to search for and evaluate published works in the field of statistical methodology will find the present volume useful. Professor Buros is to be commended for his efforts in making this work available.

NEW BOOKS RECEIVED

STATISTICAL QUALITY CONTROL, Second Edition, by Eugene L. Grant, 1952. McGraw-Hill. 557 + xiv pp. $6.50.

WORK MEASUREMENT: NEW PRINCIPLES AND PROCEDURES by A. Abruzzi, 1952. Columbia University Press.

STATISTICAL THEORY WITH ENGINEERING APPLICATIONS by A. Hald, 1952. John Wiley and Sons. 783 + xii pp. $9.00.

STATISTICAL TABLES AND FORMULAS by A. Hald, 1952. John Wiley and Sons. 97 pp. paper bound. $2.50.

INDUSTRIAL PROCESS CONTROL BY STATISTICAL METHODS by John D. Heide, 1952. McGraw-Hill. 297 pp. $6.00.

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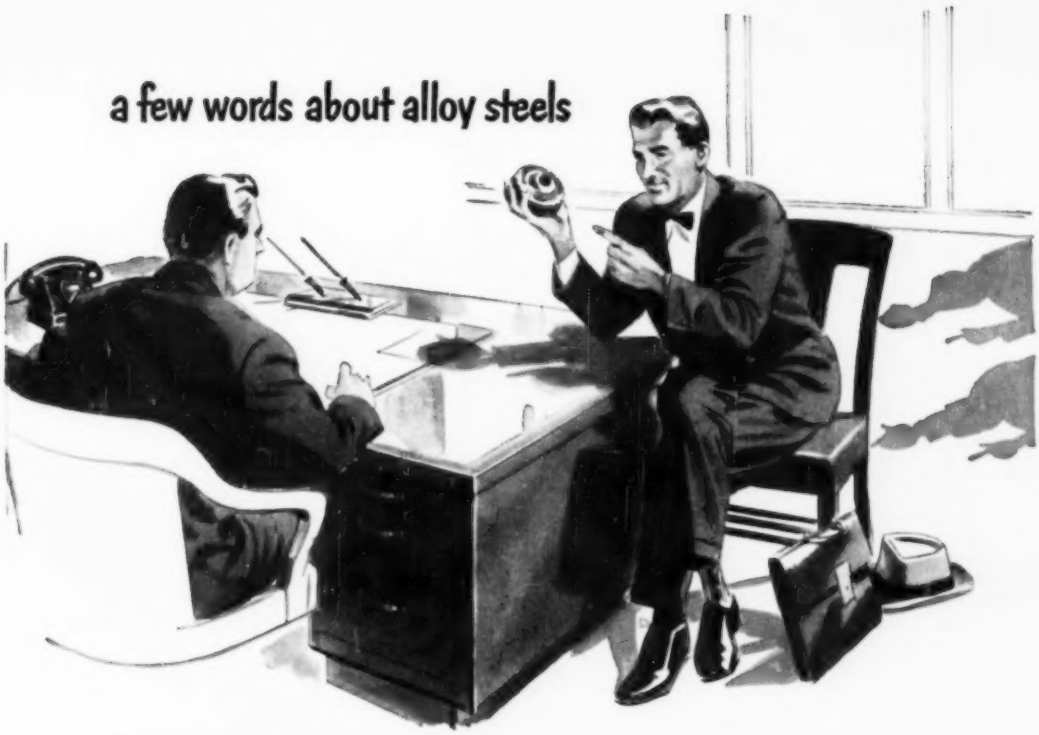

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Bibliography

JOSEPH MOVSHIN, Editor

Assisted by the Editorial Committee, St. Louis Section, ASQC

On matters concerning the Bibliography Department, send correspondence, suggestions, and contributions to: Mr. Joseph Movshin, 9220 Old Bonhomme Road, St. Louis 24, Mo.

BIBLIOGRAPHICAL

EXPERIMENTAL STATISTICS, R. J. Hader, N. C. State College, Raleigh, N. C. and W. J. Youden, National Bureau of Standards, Washington, D. C.
(Analytical Chemistry, v. 24, n. 1. Jan. 1952, p. 120)

This article is a bibliography of some 154 references on the use of statistical techniques, particularly with respect to the Chemical Industry. Books and periodical references are included with some notes as to those falling within certain categories such as Curve Fitting, Design of Experiments, Biological Assay, Teaching & QC.

ANALYSIS OF VARIANCE

RATING NEW TEST METHODS, Eugene D. Goddess, Sylvania Electric Products, Inc., Boston, Massachusetts.
(Electronics, v. 5, n. 4 Apr. 1952, p. 101)

Mr. Goddess discusses a method for the classification of tests when such tests can result in good items being called bad and bad items being called good. This is based on a method by Dr. W. J. Youden of the National Bureau of Standards. This method was discussed in the January 1950 issue of Cancer. In Mr. Goddess's article a J-index is determined which acts as a measure of the reliability of the classifications found. Confidence levels in terms of two J-indices may be determined. An illustration of this in testing magnetron tubes is given.

APPLICATION—CHEMICAL INDUSTRY

RANDOM FLIGHT WITH MULTIPLE PARTIAL CORRELATIONS, C. M. Tchen, National Bureau of Standards, Washington, D. C.
(The Journal of Chemical Physics, v. 20, n. 2, Feb. 1952, p. 214)

Multiple partial correlation is used as a model to study random flight in linear polymers. Problems of free rotation and symmetrical restricted rotation in polymers appear to have the fundamental statistical properties of one or two partial correlations. From this, generalization to higher orders of partial correlations is made.

APPLICATION—ELECTRICAL INDUSTRY

STATISTICAL METHODS IN A UTILITY, E. L. Hartman
(Electrical Engineering, v. 70, n. 12, Dec. 1951, p. 1047)

Mr. Hartman presents the general applicability of statistical methods to typical problems encountered by the Hydro-Electric Power Commission of Ontario. Examples of the use of the control chart and control chart methods are noted briefly. The use of the statistical approach to sampling in specification and acceptance activities are discussed. Reference is also made to the use of other statistical methods for the "analysis of data."

APPLICATION—MISCELLANEOUS

MEASURE MAN, NOT PRODUCT, by Roger L. Putnam, Jr., Production Manager, Package Machinery Co., East Long Meadow, Massachusetts and Harry A. Dorsey, Senior Associate, Bruce Payne and Associates, Westport, Conn.
(Factory Management and Maintenance, v. 110, n. 5, May 1952, p. 128)

"A new twist in Statistical Quality Control" in which the quality of each operator instead of each production lot is measured and controlled. Essentially X and R charts with arbitrary "control units" as the variables.

ENGINEERING & EXPERIMENTS

OPERATIONS RESEARCH—STATISTICAL SCIENCE APPLIED TO ENGINEERING PROBLEMS, Earl Lamm, Research Engineer, Battelle Memorial Institute.
(Machine Design, v. 24, n. 3, March 1952, p. 102)

Following a resumé of the Anglo-martial beginnings of Operations Research, the author lists nine steps in the conduct of an Operations Research problem, and illustrates these by specific examples. The distinguishing characteristics of Operations Research are emphasized to shed light on the question of the difference between OR and QC. The dependence of OR on probability theory and statistics is noted.

CAN YOUR PROCESSES HOLD THE TOLERANCES YOU'VE SET, J. M. Juran, Consulting Management Engineer, N. Y.
(Factory Management and Maintenance, v. 110, n. 6, June 1952, p. 118)

This article presents charts and case studies from seven companies, showing how they have improved their processes by making process capability studies and then doing something about it. A variety of products and techniques is shown.

MANAGEMENT AND PERSONNEL

MODERN QUALITY CONTROLS ARE SIMPLE TO USE, H. F. Myers, United States Steel Co., Pittsburgh, California.
(The Iron Age, v. 169, n. 18, May 1, 1952, p. 144)

This explains the purpose of Quality Control in a business, the requirements of control, the part played by cost in a specification, what the control chart does, etc. The control chart is useful in searching for the causes of variability in a process that is too complex to handle by other usual techniques.

INTRODUCING QUALITY CONTROL TO SHOP PERSONNEL, Earl Lamm, Engineering Economics Division, Battelle Memorial Institute.
(Modern Machine Shop, v. 24, n. 10, March 1952, p. 176)

The problems encountered in installing QC are described, including a candid discussion of objections met, and a modest claim of benefits. Clever illustrations lend emphasis to the main theme of improved methods made possible by QC.

BETTER QUALITY VIA THE SUGGESTION BOX, Joseph Manuele, Westinghouse Electric Corporation.
(Mill and Factory, v. 49, n. 4, Oct. 1951, p. 99)

Use your employes' ideas to improve quality. After control charts have shown problems needing correction, offer prizes for good ideas that solve these problems. Be sure to use any ideas that are accepted.

MISCELLANEOUS

QUALITY CONTROL—YOU'LL NEED A SYSTEM, C. W. Kennedy, Federal Products Corporation, Providence, R. I.
(Steel, v. 130, n. 20, May 19, 1952, p. 90)

In producing for a government contract, an effective quality control system is practically required. To meet the military sampling plans (statistical) some statistical method must be employed. Average and range charts and *p* charts are used in the illustration given.

FOR BETTER QUALITY, PLAY THE ODDS, Levin H. Campbell, Jr.
(The Management Review, v. XLI, n. 1, Jan. 1952, p. 31)

A brief review of an address by Levin H. Campbell, Jr., on the basis for, and value of statistical methods.

THEORY & APPLICATION—GENERAL

FIVE, VARIABLE FLOTATION TESTS USING FACTORIAL DESIGN, Adrian C. Dorenfeld.
(Mining Engineering, v. 3, n. 12, Dec. 1951, p. 1073)

A method of factorial design is illustrated in some detail in an application to five variable flotation tests. This article starts with the definition of the normal distribution curve, the average, the standard deviation and variance. Illustrated tables for the complicated analysis of variance and other significant tests are developed. The article is illustrated in detail with numerical tables and examples of the procedures given.

STATISTICS

RANDOM DETERMINANTS, R. Fortet
(Journal of Research of the National Bureau of Standards, v. 47, n. 6, Dec. 1951, p. 465)

Expressions are derived for the first and second moments of determinants whose elements in-

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volve random variables. Application includes finding limited probability for the event — "a given point lies above a random hyperplane."

ON THE DERIVATION AND ACCURACY OF CERTAIN FORMULAS FOR SAMPLE SIZES AND OPERATING CHARACTERISTICS OF NON-SEQUENTIAL SAMPLING PROCEDURES, Uttam Chand, Indian Council of Agricultural Research, New Delhi, India.
(Journal of Research of the National Bureau of Standards, v. 47, n. 6, Dec. 1951, p. 491)

UNIFORMLY BEST CONSTANT RISK AND MINIMAX POINT ESTIMATES, Raymond P. Peterson.
(Journal of Research of the National Bureau of Standards, v. 48, n. 1, Jan. 1952, p. 49)

SOME NONNEGATIVE TRIGONOMETRIC POLYNOMIALS CONNECTED WITH A PROBLEM IN PROBABILITY, Eugene Lukacs and Otto Szasz
(Journal of Research of the National Bureau of Standards, v. 48, n. 2, Feb. 1952, p. 139)

THE RELIABILITY OF TELEPHONE TRAFFIC LOAD MEASUREMENTS BY SWITCH COUNTS, W. S. Hayward, Jr.
(The Bell System Technical Journal, v. XXXI, n. 2, March 1952, p. 357)

ON SOME STATISTICAL PROPERTIES OF HYDRODYNAMICAL AND MAGNETO-HYDRODYNAMICAL FIELDS, T. D. Lee, University of California, Berkeley, Cal.
(Quarterly of Applied Math., v. X, n. 1, Apr. 1952, p. 69)

(Advertisement)

STATISTICAL QUALITY CONTROL IN JAPANESE INDUSTRY

K. KOYANAGI

Containing programs of seminars and teaching, and accounts of results in manufacturing plants of various kinds. Presented at the meeting of the ASQC in Syracuse, May, 1952. Obtainable from the office of the American Statistical Association, 1108 Sixteenth Street, Washington 6, D. C.; price 50c.

ON THE POWER FUNCTION OF TESTS OF RANDOMNESS BASED ON RUNS UP AND DOWN, Howard Levene, Columbia University.

A BAYES APPROACH TO A QUALITY CONTROL MODEL, M. A. Girshick and Herman Rubin, Stanford University.
(The Annals of Mathematical Statistics, v. 23, n. 1, March 19, 1952, p. 114)

FORMULAS FOR THE GROUP SEQUENTIAL SAMPLING OF ATTRIBUTES, Howard L. Jones, Illinois Bell Telephone Company
(The Annals of Mathematical Statistics, v. 23, n. 1, March 19, 1952, p. 72)

REPORTED—NOT REVIEWED

MATHEMATICS OF INSPECTION OF MASS-PRODUCED ARTICLES BY SAMPLING, J. Jennings.
(Mech. World, v. 129, p. 319, Apr. 6, 1951)

CONTROL OF PRODUCT QUALITY, M. L. Yates
(Mech. World, v. 131, p. 17, Jan. 1952)

ENGINEERING ADMINISTRATION DEPARTMENT

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Management's Corner

J. M. JURAN, Editor

AT THE SYRACUSE Convention of ASQC, the editor of this department played the role of moderator in the panel session "What Is the Quality Control Job?" It was a memorable experience. Close to a thousand people filled the grand ballroom of the Hotel Syracuse to hear panel members Ernest Robinson, Ray Saddoris and Hugh Smallwood. The panel members were a sharp lot, they stuck to the subject, and they gave forthright and realistic answers.

The meeting was opened precisely at the scheduled time and proceeded at a fast pace. When the meeting was concluded, again precisely at the scheduled time, interest was probably at its peak. Only a quarter of the audience questions had been answered. We undoubtedly quit while we were ahead.

All was unrehearsed, extemporaneous. We did have breakfast together. (Robinson takes his eggs scrambled, Saddoris fried, Smallwood and Juran boiled.) But we bogged down at once in the mire of terminology. Smallwood brought us out by suggesting we describe a hypothetical company as a means of agreeing, pro tem, on terminology.

The panel session was too crowded to permit oral discussion from the floor. Instead, we asked the floor to send up written questions. The first call brought up 71 questions, far more than could be discussed in the time available.

Correspondence is invited on potential contributions or problems appropriate for discussion in this department. Address your suggestions to:

J. M. JURAN
195 Beech Street
Tuckahoe, N.Y.

No less than 23 questions dealt with organization problems in quality control. Mainly, these concerned relations of the "Quality Control Engineering" group to other departments, i.e., inspection, production, purchasing, etc. The extent of the interest in organization is a hint to program chairmen in the various sections.

A second line of questions (13 in number) concerned specifications. These questions had several flavors:

(a) How can all hands participate in agreement on the specification?
(b) How to reconcile a specification with a process incapable of holding the tolerances.
(c) Specifications for visual and other sensory characteristics.

In the discussion, this moderator had commented on the "fading distance" as a means for setting specifications for visual appearance. The following elaboration is written in self-defense, as numerous requests for elaboration followed the session.

Once agreement has been reached on a standard for appearance (how to reach this agreement is a chapter in its own right) there remains the problem of how to put this standard in effect in the shop. The usual methods are to prepare:

(a) A written description, never satisfactory because of the inevitable reliance on a uniform interpretation of adjectives.
(b) Physical samples of the standard. This is limited in application because:
    1. Where numerous kinds of defects are involved, the job of selecting duplicate samples for all defects becomes forbidding.
    2. Even a single type of defect (scratches) may exist in bewildering permutations of length, width and depth.
    3. The samples (or the conditions they depict) are often perishable.
(c) Photographs, even in color or in stereoscopic form. Some object to these as not being like the "real thing" in any event.

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The "fading distance" is an ingenious extension of the old principle of standardizing the conditions under which inspection takes place. The quality standard for acceptance is anything which is free from visible blemishes when viewed at some specified distance known as the "fading distance."

Obviously, the length to use for a fading distance is a special study for each company. The advantage is in defining a measureable thing like length, and avoiding the sticky descriptions of various kinds of visual blemishes.

Coming back to the panel session, there were several questions dealing with qualifications of quality control engineers (Robinson had mentioned he has used a battery of tests for this purpose). There were several questions on the aspects of introducing a program of quality control. And, of course, there was a miscellaneous bag of (21) questions on a wide variety of topics. These ranged from the plaintive call "Is another reason for failure of SQC programs the fact that some people pronounce STATISTIC as if it were spelled SADISTIC and act as if the proper action to take to improve quality is to beat and lash the production people?" to the quizzical "What does the correlation coefficient 'r' stand for—the 'r' comes from what word?"

Manifestly, industrial people have many quality problems on their minds. Is ASQC working on the main problems, or on something else? Here is a challenge to ASQC chapters, researchers, committees, etc., to come up with an answer to the question "What is the agenda of Industry's quality problems?"

This agenda, which is the back-log of work for ASQC, its membership, its committees, its publications, is not to be derived from a small sample of industrialists. Neither is the agenda to be derived from enthusiasts in this or that specialty who have a vested interest in promoting their wares. The agenda should be derived from a broad research study, covering all varieties of industrial quality problems.

The need for this research is such that we can hope that some one will rise to the occasion. "When you see the need for a man, be thou that man."

Some of our sections and regions are well heeled as to funds and as to the men needed to carry on such a research. How about it?

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ANNUAL REPORTS

In accordance with the provisions of the Constitution, the Annual Meeting of the American Society for Quality Control, Inc. was held in Syracuse, New York on May 22, 1952. The President, Executive Secretary, and Treasurer presented annual reports to the membership on behalf of the Board of Directors. The reports have been extended to include the balance of the fiscal year ending June 30, 1952, and are published below, while a more detailed report of the Annual Meeting appears under the ASQC News section of this issue.

REPORT OF THE BOARD OF DIRECTORS

The Board of Directors of the American Society for Quality Control, Inc., presents herewith its Sixth Annual Report, covering the fiscal year from July 1, 1951 to June 30, 1952. This is intended only as a brief summary of some of the major Society activities, more detailed information having been published in Industrial Quality Control throughout the past year.

The reports of the Executive Secretary and the Treasurer are appended hereto; certificate of audit accompanies the latter.

EXECUTIVE COMMITTEE MEETINGS

Four meetings were held during the year, as follows:

New York—September 8-9, 1951
Chicago—November 17-18, 1951
Cleveland—February 9-10, 1952
Syracuse—May 21, 1952

These meetings were devoted to problems involved in the operation of the Society and to laying plans for future expansion. The major highlights were published in the various issues of Industrial Quality Control.

MEMBERSHIP

The number of Sections increased from 48 to 60 during the past year with the addition of the following:

Lansdale (Pennsylvania)	Albany (N.Y.)
Mexico City (Mexico)	Dallas-Ft. Worth (Texas)
Wichita (Kansas)	San Diego (Calif.)
Buzzards Bay (Mass.)	Worcester (Mass.)
Huntsville (Ala.)	Evansville-Owensboro
Utica (N.Y.)	(Ind.-Ky.)

The report of the Executive Secretary shows a total membership of 6,109 at the end of the year—a growth of 44 percent from the 4,245 members a year ago. A highly gratifying fact is that 81 percent of last year's members renewed their membership this year. New members totaled 2,669.

MEETINGS

An important factor in the growth of our Society was the outstanding nature of the technical and social programs offered by the various Sections. These provided special impetus for the customary series of established Conferences; New England, Middle Atlantic, Michigan, and Midwest had highly successful affairs, and there were many other special conferences in various parts of the country. The climax was the Sixth National Convention in Syracuse, attended by some 2,000 persons.

PUBLICATIONS

The Editorial Board has done a splendid job in providing new and added features to increase reader interest in Industrial Quality Control. The expansion program embarked upon in July, 1951 provided additional space for editorial copy, as well as advertising. The average pages per issue (exclusive of the May or Convention issue) has increased from 33.6 in Vol. VI to 43.2 in Vol. VII, to 49.6 in Vol. VIII, last year. Paid advertising, on the same basis, has increased from 4.2 pages per issue to 8.8 pages in Vol. VII, and to 15.0 pages in Vol. VIII. Our circulation has increased to nearly 7,000 copies.

The News Supplement kept pace with the growth of the Society by increasing its coverage some 25 percent. This publication has become increasingly popular with our members.

Still further increases in our publications activities are planned for the ensuing year, and to put all of the many phases of this important Society activity on a business-like basis, the Board of Directors has authorized the establishment of a Publications Business Office in Milwaukee, under the direction of a full-time, salaried manager, effective September 1, 1952. Mr. George R. Foster has been retained to fill this capacity.

The Board wishes to accord full recognition to Messrs. Wescott, Robinson and Saddoris for their able leadership and intense interest in making the foregoing possible.

AWARDS

The following awards were presented at the Annual Banquet of the Society in Syracuse on May 22, 1952:

The 1951 Shewhart Medal to George D. Edwards of New York, N.Y., in recognition of his outstanding contribution to the field of Quality Control.

The citation presented by Martin A. Brumbaugh, and the Medalist Address were published in the July, 1952 issue of Industrial Quality Control.

The Brumbaugh Award to Dorian Shainin, East Hartford, Connecticut, for the excellence of his paper "The Hamilton Standard Lot Plot Method of Acceptance Sampling by Variables," published in the July, 1950 issue of Industrial Quality Control.

BOARD OF DIRECTORS MEETING

There was but one meeting of the Board during the year, held in Syracuse on May 24, 1952. In addition, three mail ballots were conducted during the year.

The President reported the highlights from the reports of the Chairmen of the various Society committees—29 in number—and the Executive Secretary and Treasurer presented their annual reports, which were approved. The Board approved the action of the Executive Committee in extending charters to the eleven new Sections.

The President reviewed the Society's investment policy approved by the Executive Committee, and the Board endorsed this action. The Board also established a Financial Advisory Committee, and appointed the following to serve: Alfred L. Davis, George D. Edwards, and Wade R. Weaver (Chairman).

The report of the Chairman of the Editorial Board was presented and approved.

The report of the Examining Committee was presented and approved. Certain material therefrom appears in subsequent paragraphs.

The President requested and received approval from the Board to appoint an Historical Committee.

The President presented tabulations expressing the financial growth of the Society since its founding, and commented upon the improving financial security thus portrayed.

The Publications Management Plan, as approved by the Executive Committee, was presented in considerable detail, the Board endorsing the action taken on this subject.

The problems involved in the establishment of "Divisions" of the Society, the formal organizing of groups of members within a field of common interest, was discussed at length. The Board approved the policy of granting charters

to duly organized groups as Divisions. The Textile Division will be the first of such Divisions, and plans are under way to establish a Chemical Division.

The President-elect presented for consideration of the Board a tentative budget for the fiscal year 1952-53. This budget was discussed and will be submitted for adoption to the Executive Committee at its first meeting.

The membership of the Society voted favorably upon a recommendation by the Board for numerous constitutional reforms involving the administrative set-up of the Society, and the President reviewed the procedure by which the "intent" voted by the members will be transferred into the necessary revisions in the Constitution.

ACKNOWLEDGMENT

The Board of Directors wishes to express its sincere appreciation to the Executive Committee, all Society Committees, and Committee Chairmen, and to all Section Officers, for the splendid work done during the year. The loyal support and contributions of personal time and effort have been responsible for the development and strengthening of our Society, and the Board acknowledges this with genuine thanks.

Cleveland, Ohio
June 30, 1952

For the Board of Directors
WADE R. WEAVER, President

REPORT OF THE EXECUTIVE SECRETARY FOR THE 1951-52 FISCAL YEAR

The 1951-52 fiscal year was the most successful in the history of the Society in terms of increase in the membership, both percentagewise and in actual number of members; also, in number of new members. The figures are set forth in the accompanying Exhibit A. Two major causes for this increase are:

(1) Hard and effective work by many of the Sections in securing renewals and new members.

(2) Organization of new Sections in previously untapped areas.

For instance, the Dallas-Fort Worth Section, organized during the year, was admitted to the Society with 175 members, all except five of whom were new members. The San Diego Section, also organized during the year, was admitted with 111 members, all except one of whom were new members. The membership status of the various Sections is shown in Exhibit B.

The membership of the Society as of June 30, 1952 was composed as follows:

	New Members	Renewing	Total
Fellows		125	125
Senior Members	617	1276	1893
Members	2005	2037	4042
Totals	2622	3438	6060
Members-in-Training	47	3	49
Grand Total	2669	3440	6109

By comparing the above totals with those of June 30, 1951, it is noted that 92 percent of the 1950-51 Senior members and Fellows renewed their memberships in 1951-52, as compared with 75 percent of the Member grade members. During th 1951-52 fiscal year, there were 233 transfers between Sections. The largest number to transfer in one group was 70 members, who transferred from Philadelphia to the new Lansdale Section.

New Sections recognized during the fiscal year in order of their recognition are as follows:

Lansdale	—49th Section
Mexico City	—50th Section
Wichita	—51st Section
Buzzards Bay	—52nd Section
Huntsville	—53rd Section
Albany	—54th Section
Dallas-Fort Worth	—55th Section
San Diego	—56th Section
Worcester	—57th Section
Evansville-Owensboro	—58th Section
Utica	—59th Section
Allentown-Bethlehem	—60th Section

The Racine and University of Western Ontario Sections were recognized near the end of the 1950-51 fiscal year and first enrolled members as of July 1, 1951.

In addition, there are several prospective new Sections in various stages of organization.

During the year the Society purchased addressograph equipment, and since October 1951 we have been handling our own mailing list, rather than having it done through a commercial establishment as heretofore. Four important gains have resulted.

(1) The list is more accurate.

(2) The savings have enabled us to liquidate a substantial part of the cost of the equipment.

(3) The processing of memberships and changes of address are handled much more quickly, the net gain being an average of about three weeks. This means that new memberships are added to the mailing list three weeks sooner and back issues are sent that much sooner as well.

(4) The preparation of special lists has been handled more efficiently.

The office of the Executive Secretary has also taken over the handling of technical literature, back issues of INDUSTRIAL QUALITY CONTROL for sale, and the institutional subscribers list. This was formerly a function of the Treasurer's office.

The office of the Executive Secretary continues to act as an employment clearing house between members of the Society and industry. However, we have been notified of several positions available that we have been unable to fill because of lack of qualified applicants.

The Manual Covering Relations Between the Sections and the Office of the Executive Secretary was revised for the third time to bring it up to date with current procedures and was re-issued under date of May 1, 1952.

An Operating Handbook has also been prepared and sent to all section secretaries, chairmen, national directors and officers.

As of January 1, 1952, the Executive Secretary's office was expanded to include both rooms of a two-room office, rather than only one. However, it is to be noted that we are handling the work connected with 6,000 memberships with essentially the same staff as when we had 3,000 members. In addition, we have approximately 500 institutional subscriptions, making a total mailing list for INDUSTRIAL QUALITY CONTROL of approximately 6,500.

It has been the pleasure of your Executive Secretary to serve this Society in an official capacity since its founding in 1946. It has been a gratifying experience to observe the growth of the Society both in membership and financial resources. It is particularly satisfying to note the increasingly important role of the Society in providing leadership to industry and business in the application of statistical quality control.

EXHIBIT A—Membership Growth of American Society for Quality Control, Inc.

Date	Membership	Percent Renewals from previous fiscal years	Net Gain in Membership from previous fiscal year Number	Percent	New Members	Active Sections	Memberships rec'd for following fiscal year
June 30, 1947	1926				1926	25	*
June 30, 1948	2102	*	176	9	*	31	*
June 30, 1949	2638	75	536	25	1058	35	*
June 30, 1950	3510	77	872	33	1489	42	58
June 30, 1951	4245	80	735	21	1422	48#	167
June 30, 1952	6109	81	1864	44	2669	60	207

*No record. #And one provisionally accepted.

Exhibit B—American Society for Quality Control Inc.—Membership Report as of June 30, 1952

Region and Section	Membership June 30, 1951	Membership, June 30, 1952 Fellows	Senior Members	Members	Total
New England Region					
Albany		1	12	40	53
Boston	129	4	61	112	177
Hartford	139	1	33	150	184
N. Hampshire	21	1	3	20	24
Rhode Island	39	1	8	26	35
So. Conn.	59	1	32	62	95
W. Mass	62	3	30	28	61
Buzzards Bay			2	37	39
TOTAL	449	12	181	475	668
Mid-Atlantic Region					
Baltimore	44	1	13	48	62
Delaware	38	4	8	28	40
Lansdale		1	14	89	104
Metropolitan	348	24	167	239	430
Philadelphia	237	5	84	128	217
Washington	44	2	22	50	74
TOTAL	711	37	308	582	927
Northern Region					
Buffalo	57	1	19	48	68
Mid-Hudson	33	1	13	31	45
Montreal	30	1	11	50	62
Rochester	73	3	83	17	103
So. Tier	64	1	19	66	86
Syracuse	108	2	30	100	132
Toronto	64	1	7	74	82
W. Ontario			19	36	55
TOTAL	429	10	201	422	633
Central Region					
Birmingham	45			47	47
Cincinnati	57	1	16	49	66
Cleveland	264	7	96	196	299
Columbus	40	1	14	30	45
Dayton	97	2	23	82	107
Erie	41		4	47	51
Georgia	35	2	19	25	46
Michigan	223	3	69	206	278
Muskegon	31		15	25	40
Parkersburg	42		1	33	34
Pittsburgh	68	4	29	45	78
Tennessee	63	1	21	39	61
Toledo	66	1	7	72	80
Huntsville			8	41	49
TOTAL	1072	22	322	937	1281

Region and Section	Membership June 30, 1951	Membership, June 30, 1952 Fellows	Senior Members	Members	Total
Midwest Region					
Dallas-Ft. Worth			93	104	197
Central Ill.	27	2	22	11	35
Chicago	233	11	121	270	402
Denver	31	1	7	26	34
Evansville	14		6	20	26
Indianapolis	346	4	79	325	408
Iowa	124	7	110	49	166
Milwaukee	147	1	90	185	276
Minnesota	38	1	26	33	60
Muncie	36		11	25	36
N. E. Indiana	46	2	14	39	55
Racine			20	30	50
Rock River V.	50	1	16	28	45
St. Louis	115	5	36	100	141
So. Texas	42	1	4	56	61
Wichita			1	37	38
TOTAL	1249	36	656	1338	2030
Western Region					
Mexico City			1	21	22
Los Angeles	56	3	51	58	112
San Francisco	45	1	13	42	56
Seattle	21		1	32	33
San Diego			112	21	133
TOTAL	122	4	178	174	356
Members-at-Large	189	4	47	114	165
Members-in-Training	24				49
GRAND TOTALS	4245	125	1893	4042	6109

In retiring from office in this Society, I extend my sincerest thanks to the officers and members who have given me such valued assistance over the years. I am particularly grateful to Mr. Julian Herz who has served so well as Manager of our Society headquarters office in New York.

Respectfully submitted,

New York, N. Y. — *ALFRED L. DAVIS*
July 15, 1952 — Executive Secretary

REPORT OF TREASURER

I respectfully submit the Balance Sheet of the Society (Exhibit C), Statement of Cash Receipts and Disbursements for the fiscal year July 1, 1951 to June 30, 1952 (Exhibit D), and a record of the Investments of the Society as of June 30, 1952 (Exhibit E).

Englcott, New York — *PAUL A. ROBERT*
July 22, 1952 — Treasurer

EXHIBIT C — BALANCE SHEET — June 30, 1952
AMERICAN SOCIETY FOR QUALITY CONTROL, INCORPORATED

Assets			
Cash:			
Current funds:			
Demand deposit	$ 6,057.47		
On hand for deposit	434.63		
Time deposits—general	27,964.07		
Time deposit—Convention reserve fund	6,128.18	$40,584.35	
Petty cash funds		125.00	
Special funds:			
Shewhart Medal Fund	$ 351.24		
Brumbaugh Award Fund	1,094.75		
Investment Income Fund	246.78	1,692.77	$42,402.12
Marketable securities (at cost):			
United States Treasury bonds (market value $2,949.38)		$ 2,910.31	
Other marketable securities (market value $17,381.55)		16,744.40	19,654.71

EXHIBIT C — BALANCE SHEET (Concluded)

Accounts receivable:		
Sales of magazine reprints and back issues, conference papers and technical literature, etc.	$ 467.78	
Library subscriptions	60.00	
Advertising	2,144.60	
Advances to 1953 and 1954 Convention Committees	600.00	
Accrued interest on time deposits	150.50	3,422.88
Inventories—at nominal amounts:		
Back issues of Industrial Quality Control, conference papers and other technical literature	$ 1.00	
Stationery and supplies	1.00	2.00
Office furniture and equipment—at nominal amount		1.00
		$65,482.71
Liabilities and Surplus		
Pay roll taxes and taxes withheld from employees		$ 417.74
Deferred income:		
Membership dues paid in advance	$ 1,027.50	
Estimated unearned portion of library subscriptions	1,626.00	2,653.50
Reserves:		
For Shewhart Medal Fund	$ 351.24	
For Brumbaugh Award Fund	1,094.75	1,445.99
Surplus		60,965.48
		$65,482.71

EXHIBIT D — STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS

AMERICAN SOCIETY FOR QUALITY CONTROL, INCORPORATED

Year ended June 30, 1952

CURRENT FUNDS

Receipts:			
Membership dues:			
Members in training	$ 106.50		
Regular members	22,990.75		
Senior members	14,487.00		
Fellows	1,450.00		
Overpayments	53.00	$39,087.25	
Less refunds of overpayments		335.00	$38,752.25
Publications:			
Advertising	$15,865.16		
Library subscriptions	3,206.50		
Sales of back issues	2,278.95		
Sales of reprints	789.20	$22,139.81	
Less cost of reprints		485.19	21,654.62
Sales of Conference Papers and other technical literature		$ 1,083.09	
Less cost of printing		225.00	858.09
Sales of Society pins		$ 903.57	
Less cost of pins		448.44	455.13
Interest received on bank deposits			378.24
Sales of cuts and insignia			78.75
Annual Society Conventions:			
For year ended June 30, 1951	$15,889.67		
Less expenses paid after June 30, 1951	209.81	$15,679.86	

For year ended June 30, 1952	$ 4,183.16		
Less convention expenses paid by National Treasurer	17.51	4,165.65	
Refund by 1952 Committee		1,000.00	20,845.51
Sustaining contributions and miscellaneous income			214.00
Income and social security taxes withheld from employees		$ 1,375.85	
Less payments made to Collector of Internal Revenue		1,000.26	375.59
			TOTAL $83,612.18
Disbursements:			
Publications:			
Publishing—magazine		$14,779.15	
Publishing—news supplement		1,329.70	
Reprinting back issues		202.55	
Postage and mailing expense:			
Magazine		2,124.99	
News supplement		650.72	
Back issues		250.11	
General		151.89	
Office supplies and expense		246.73	
Secretarial services		1,440.00	
Advertising commissions and cash discounts allowed		1,515.32	
Traveling expense		581.09	23,272.25
Committees and Sections:			
Section stationery less reimbursements received		$ 44.54	
Public relations material, postage and sundry expense		160.70	
Executive Committee meetings and sundry expenses		619.31	824.55
President and Vice President:			
Office supplies and expense		$ 118.66	
Traveling expense		21.50	140.16
Executive Secretary:			
Secretarial salaries		$ 8,492.70	
Printing and mimeographing		1,031.10	
Postage		1,062.73	
Office supplies and expense		2,210.40	
Office rent (less sub-lease income $222.00)		995.50	
Traveling expense		460.32	
Office equipment (less cabinet sold—$10.00)		1,980.93	16,233.68
Treasurer:			
Office supplies and expense		$ 27.74	
Compensation insurance and bond premium		141.13	
Bank collection and exchange fees		53.46	
Traveling expense		172.38	
Accounting services		200.00	
Miscellaneous expense		9.15	603.86
General:			
Pay roll tax expense			97.34
Purchase of investment securities (Including $32.83 accrued bond interest)			19,687.54
Advances to 1953 and 1954 Convention Committees			600.00
Increase in amounts of imprest petty cash funds			24.04
TOTAL			$61,483.42
CASH RECEIPTS IN EXCESS OF CASH DISBURSEMENTS			$22,128.76
Cash on deposit at June 30, 1951			18,455.59
Cash on hand and on deposit at June 30, 1952			$40,584.35

SPECIAL FUNDS

Shewhart Medal Fund:

Receipts:	
Contributions by various sections	$ 330.00
Interest received on bank deposit	4.09
	$ 334.09

EXHIBIT D—CASH STATEMENT (Concluded)

Disbursements:	
Cost of engraving medal and preparation of certificate	53.46
CASH RECEIPTS IN EXCESS OF CASH DISBURSEMENTS	$ 280.63
Cash on deposit at June 30, 1951	70.61
Cash on deposit at June 30, 1952	$ 351.24
Brumbaugh Award Fund:	
Receipts:	
Contributions by various sections	$ 200.00
Interest received on bank deposit	20.02
	$ 220.02
Disbursements:	
Cash award to Dorian Shainin	50.00
CASH RECEIPTS IN EXCESS OF CASH DISBURSEMENTS	$ 170.02
Cash on hand June 30, 1951	924.73
Cash on hand June 30, 1952	$ 1,094.75

EXHIBIT E — MARKETABLE SECURITIES — June 30, 1952
AMERICAN SOCIETY FOR QUALITY CONTROL, INCORPORATED

Description	Shares	Rate and Maturity	Principal Amount	Cost	Market Value	Income Received
UNITED STATES BONDS						
U.S. Treasury bonds		2½'s 1969	$3,000.00	$ 2,910.31	$ 2,949.38	$ 37.50
OTHER BONDS						
American Tobacco Co. debentures		3's 10/15/69	1,000.00	988.30	1,009.37	15.00
American Telephone and Telegraph Co. convertible debenture		2¾'s 12/15/61	1,000.00	1,075.80	1,088.75	13.75
				$ 2,064.10	$ 2,098.12	$ 28.75
PREFERRED STOCKS	Shares		Par			
Consolidated Edison Co. of New York	10	$5 Cum.	N.P.	1,094.10	1,071.87	12.50
B. F. Goodrich Co.	10	$5 Cum.	N.P.	1,062.25	1,032.50	12.50
Virginian Railway Co.	40	6% Cum.	$25.00	1,159.76	1,205.00	15.00
				$ 3,316.11	$ 3,309.37	$ 40.00
COMMON STOCKS						
Cincinnati Gas and Electric Co.	30		$ 8.50	1,180.68	1,160.63	15.00
Continental Can Co.	25		20.00	1,075.30	1,190.62	12.50
E. I. DuPont de Nemours and Co.	20		5.00	1,700.06	1,736.25	17.00
General American Transportation Corp.	20		5.00	1,090.06	1,215.00	15.00
Liggett and Myers Tobacco Co.	20		25.00	1,375.95	1,338.75	20.00
Standard Oil Co. of N. J.	20		15.00	1,495.18	1,617.50	20.00
Union Carbide and Carbon Co.	20		N.P.	1,161.20	1,346.25	10.00
United Fruit Co.	30		N.P.	1,201.20	1,255.00	25.00
F. W. Woolworth Co.	25		10.00	1,084.56	1,114.06	12.50
				$11,364.19	$11,974.06	$147.00
			TOTAL	$19,654.71	$20,330.93	$253.25
				Less lock box rental and bank service charges ..		6.47
				CASH ON DEPOSIT—CLEVELAND TRUST COMPANY		$246.78

REPORT OF AUDITING COMMITTEE

Ernst & Ernst, Certified Public Accountants, were retained to audit the books of the American Society for Quality Control, Inc. Relying on this audit and the certificate of Ernst & Ernst, we are of the opinion that the accompanying Balance Sheet and Statement of Receipts and Disbursements fairly present the financial position of the Society as of June 30, 1952, and its recorded cash transactions for the fiscal year ending that date.

Auditing Committee

HOWARD R. BOLTON
CLARENCE R. BURDICK
G. RUPERT GAUSE
JOSEPH R. SADOWSKI
HOWARD L. JONES, Chairman

Chicago, Ill.
July 15, 1952

CERTIFICATE OF AUDIT

American Society for Quality Control, Incorporated.

We have examined the balance sheet of American Society for Quality Control, Incorporated as of June 30, 1952 and the statement of cash receipts and disbursements for the year then ended and, without making a detailed audit of the transactions, have examined or tested accounting records maintained by the Treasurer of the Society, and other supporting evidence as hereinafter outlined.

Cash on deposit at June 30, 1952 was reconciled with amounts reported to us by the depositories and we counted the cash on hand for deposit. We traced the recorded cash receipts for the fiscal year to deposits shown by bank statements on file, test checked reports made by the Executive Secretary in support of amounts recorded as having been received for membership dues and tested other data on file

supporting other recorded cash receipts. We inspected canceled bank checks and traced them to the recorded cash disbursements for the year. We also inspected invoices and other data supporting the recorded disbursements for a period of four months selected by us.

We examined data and checked computations supporting amounts shown in the balance sheet for accounts receivable and deferred income at June 30, 1952.

We inspected marketable securities, held in custody of the Deputy Treasurer, and reconciled the reported income therefrom with the cash on deposit which was confirmed to us by Cleveland Trust Company.

In our opinion, based upon our examination as outlined above, the accompanying balance sheet and statement of cash receipts and disbursements present fairly the financial position of American Society for Quality Control, Incorporated at June 30, 1952 and the recorded cash transactions of the Society for the year then ended.

Rochester, N.Y. ERNST & ERNST
July 7, 1952.

REPORT OF EXAMINING COMMITTEE

In accordance with established custom, the list of those members transferring to the grade of Fellow during the 1951-52 fiscal year is published herewith.

Max Astrachan	Lloyd E. Lawrence
Jas. H. Batchelor	Paul K. Leatherman
Wayne M. Biklen	William C. Lee
Clarence R. Burdick	Halmond L. Parks
Acheson J. Duncan	Frank E. Satterthwaite
Leslie S. Eichelberger	William H. Smith
Marsh B. Gwynn	James A. Tilton
Edward B. Haden	Waldo A. Vezeau
Chester A. Hoffman	Roy A. Wylie
J. Clayton Knapp	William J. Youden

The above twenty, together with the 124 names in the 1950-51 Year Book, give a total of 144 members having the grade of Fellow as of June 30, 1952.

The report of the Examining Committee furnished the names of thirty-eight members whom the Committee requested be invited to submit applications for transfer to the grade of Fellow.

The Chairman of this Committee, in accordance with a unanimous resolution adopted by the committee limiting the term of Chairman to two years, asked to be relieved of his duties. The Board offers its most grateful appreciation to Lloyd Knowler for his devoted service. He will continue to serve as a committee member, and a new Chairman will be appointed.

REPORT OF EDITORIAL CHAIRMAN

The following report summarizes what are believed to be the important features in the experience of Volume VIII and the prospects for Volume IX.

Data on Volume VIII

In Volume VIII, we ran three issues at 48 pages, two issues at 52 pages, and one issue at 150 pages for a total of 398 pages. This is an increase of 66 pages, or about 20%, over Volume VII. In addition, a 4-page Index of Volume VII was published and inserted with each copy distributed of the July 1951 issue of Volume VIII.

Of the 398 pages published in Volume VIII, 152.5 were used for paid ads (including Classified Ads). Percentage-wise, this is about 38.3% of total available space. The corresponding percentage figure for Volume VII is 28.6%. It may be of interest to note that even excluding the May issue, paid advertising used 31% of available page space in the other 5 issues of Volume VIII.

These figures certainly would seem to indicate that, under the able guidance of Ray Saddoris, our advertising support is enjoying a solid, healthy growth. Obviously, the responsiveness of readers to ads in our journal will be a big factor in helping to hold present advertisers and to attract new ones. Circulation-wise, we are still small from the viewpoint of an advertiser. Response-wise, this relatively small circulation can, however, exhibit a high potential. It should be—and probably is proving to be—a good investment as an advertising medium for the type of product represented by most of the ads our journal carries.

About 246 pages of Volume VIII were available for non-advertising copy. The approximate distribution of these 246 pages follows.

131 pages were used to publish 35 contributed papers, averaging $3\frac{3}{4}$ pages per paper, and ranging in length from slightly less than one page to a little over nine pages. This is 8 pages less, but 3 papers more than the comparable category for Volume VII.

50 pages were used for departmental copy, the breakdown here being as follows:

- Bibliography: 12.5 pages total; in each of the 6 issues.
- Book Reviews: 7.5 pages total; in each of the 6 issues.
- Management's Corner: 2.6 pages total; in Sept., Jan., May only.
- Practical Aids: 10.4 pages total; in Sept., Jan., March, May only.
- Problems Department: 3.7 pages total; in Sept., Jan., May only.
- Scrap Box: 3.4 pages total; in Sept., Nov., Jan., May only.
- ASQC News: 9.3 pages total; in each of the 6 issues.

Management's Corner became a new department in IQC with our September 1951 issue. Dr. J. M. Juran accepted responsibility for editing this new section for us.

Editorship of our Problems Department changed hands with the September 1951 issue—Paul C. Clifford taking over and carrying forward the work in this section begun earlier by J. Rupert Gause.

Formal advent of the Scrap Box section took place in our January 1952 issue, although copy that would normally belong to this section appeared in the two previous issues without the benefit of a departmental caption. This is primarily IQC's "Vox Pop" section, but it will often include other items of a miscellaneous nature. Your Editorial Chairman takes responsibility for siring and maintaining this section.

47 pages were used to handle the Annual Reports, the Report of the Standards Committee, publicity associated with the Fifth and Sixth Annual ASQC Conventions, and various miscellaneous Regional meeting publicity items and SQC course announcements not conveniently allocable to the News Supplement. It might be noted that almost exactly one-eighth of the total available non-advertising page space was used for convention publicity purposes. Annual Reports (required by the Constitution to be published each September) took slightly less than 4% of available page space. Together—Annual Reports plus convention publicity—slightly less than one-sixth of available page space was required to handle this sort of copy.

18 pages were used for miscellaneous items (covers, masthead, table of contents, and filler material).

Qualitatively, the 35 papers published in Volume VIII may be classified as follows:

General Interest	11
Sampling	5
Management	6
Technical and Semi-Technical	13

In the January 1952 issue, we began using a separate, heavier (100 lb. stock) cover which will be standard henceforth on all regular issues until they increase in size to a point where a still heavier cover is needed.

The printing and mailing costs for the six issues of Volume VIII amount to about $14,700; net advertising income for this volume is about $15,500. A more detailed record of income and expense, including *all* publication activities of the Society, is available in the Treasurer's Report.

News Supplement

Management of IQC's companion publication continued under the able direction of E. H. Robinson during the 1951-52 fiscal year. His report covering the progress and problems of this important publication and outlining plans for the future is given as a separate item under Annual Reports.

Editorial Board Changes

In line with the five-year rotation plan now governing tenure on the Editorial Board, June 30, 1952 will see the retirement of Martin Brumbaugh, Frederick Mosteller, and A. E. R. Westman. Replacing these men for a five-year term are Paul C. Clifford, Leonard A. Seder, and W. J. Youden.

The Society is deeply grateful to the retiring members for their guidance and loyal service to our journal, and welcomes with sincere pleasure the new members who will share responsibility for the further strengthening of Society publication policies.

Reprints for Contributors

During Volume VIII, the Executive Committee approved the recommendation of the Editorial Board to set up a reprint price schedule for contributors whereby the pro-rata cost of the first 50 copies on an order is borne by the Society as its obligation to the author. This action makes the cost of separate reprints for a contributor substantially less than it would otherwise be, and gives him a quality reproduction comparable in every respect to his paper as it appeared in IQC. An order form is sent to each contributor as soon as his paper has been published, so that the processing of contributor reprint requirements can be efficiently and equitably handled from now on. This is a genuinely significant forward step which should help toward a more satisfactory solution of a facet of our publication policy that has heretofore been a constant source of irritation and confusion. It should be emphasized that this special reprint price schedule is available *only* to the contributor; all other requests for separate reprints will be handled on an at-cost plus 10% basis.

Managing Editor

During Volume VIII, the Executive Committee, recognizing that the time has come when concrete steps should be taken to begin centralizing Society publication activity in one responsible office, wisely authorized the creation of the post of Managing Editor to be operated on a full-time, salaried basis by the best available person we could find for the appointment. With the investment the Society already has in its publication activity, and with the necessity for expansion of this activity in the very near future a virtual certainty, the continued management of it by several individuals, separated geographically, and handling their respective parts of the total effort on a voluntary, part-time basis, is manifestly preposterous.

The Society is fortunate in having found in the person of Mr. George R. Foster a young man of proved experience who will, as of September 1, 1952, begin his duties as Managing Editor for ASQC. Mr. Foster has a degree in Electrical Engineering from the University of Illinois, and comes to us from the Engineering Experiment Station on that campus where he has been Assistant Editor of the Technical Publications for the Station. In addition to his engineering background (including work in SQC), he has been in publication work of one sort or another ever since his high school days in Rockford, Illinois. He understands the responsibilities and foresees the opportunities that are implicit in this appointment. He is eager to undertake the assignment and to grow with the Society and its publication work. He will live in Milwaukee where an office will be set up for this new post. Your officers believe this step represents a real milestone in the progress of the Society.

For the present, the broad assignments that will be handled by our Managing Editor include the following:

(1) Full responsibility for the mechanics of preparing and publishing issues of IQC. The Editorial Chairman will be the agent of the Editorial Board in seeing that acceptable copy is supplied for the non-advertising contents of IQC, and will continue to be responsible for supervising publication activity in harmony with established policies. The Managing Editor will report to the Editorial Chairman and will receive such authority for the operations of his office as the Chairman is empowered to give.

(2) The Managing Editor will work with E. H. Robinson to bring at least the mechanical details, and eventually the editorship, of the News Supplement into his office. For the present, operation will continue with the Supplement appearing in alternate months. The speed and nature of the transition of the News Supplement from its present home under Mr. Robinson's full attention to its operation from the Milwaukee office will be determined jointly by Mr. Robinson and Mr. Foster, subject only to approved budgetary commitments.

(3) The Managing Editor will work with Ray Saddoris to bring into his office as rapidly and as fully as the two of them shall deem feasible the complete solicitation and servicing of advertising copy.

(4) The Managing Editor will work with the Editorial Board and the Executive Committee of ASQC to study the problems implied by the future growth of the Society and its publication needs. In particular, the question of whether IQC should continue on a 6-issue basis with more pages per issue, or move to a 12-issue basis at about its present size, incorporating in the latter case, the News Supplement as a regular departmental feature of each issue, should be brought to the point of a definite recommendation by the time of the ASQC Convention in 1953.

(5) The Managing Editor will work with the Editorial Chairman and the various Technical Committee Chairmen in planning for and carrying through the publication of the several Technical Supplements to IQC, as copy becomes available for these auxiliary publications.

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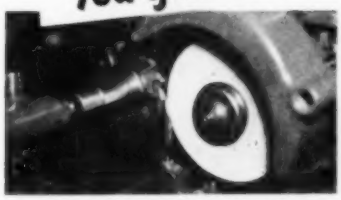

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Manuscripts

The response to the comments under this heading in this report last year has been most gratifying. We have been able to keep out in front with good, publishable papers during Volume VIII without either the embarrassment of a shortage or an oversupply.

A steady flow of manuscripts is the only way enough grist can be fed into editorial channels to insure, not only a bigger journal, but a better one. Program Chairmen for Sectional and Regional meetings are still not rendering as full service to our journal as they could by making it a part of their responsibility to see that challenging material presented on their programs is routed in the form of manuscripts to the Editorial Chairman for consideration by the Editorial Board. There has been significant improvement in this respect during Volume VIII, and IQC either has or will benefit from this closer cooperation; there is room for still greater improvement. IQC cannot use *all* of the material that *could* be made available to it. On the other hand, it should be clear that selective choice cannot be exercised unless there is an ample supply of material from which to choose. If and when IQC goes to a 12-issue basis, backlogs will be wiped out fast unless we have acquired the habit as a Society of constantly feeding into our journal potentially publishable manuscripts.

Conclusion

The Society may take justifiable pride in the progress of its journal during Volume VIII. There is every reason to believe that Volume IX will be even better. Many hands have contributed to this progress and these prospects. It has been a stimulating experience to have shared in this advancement. It is with sincere humility and pride that I look forward with your support to even greater achievement for our journal, in particular, and our total publication activity, in general.

Respectfully submitted,

Evanston, Ill. *MASON E. WESCOTT,*
May 20, 1952 Chairman, Editorial Board

NEWS SUPPLEMENT REPORT

The fiscal year 1951-52 has seen a tremendous growth in the membership of the American Society for Quality Control and in the number of its sections. With this growth in membership and section activity, there naturally was an increasing growth in the volume of news coming to your editor. Some expansion in the size of the Supplement was therefore made necessary during the year, and the number of issue pages printed increased from 34 pages in 1950-51 to 38 pages in 1951-52. It is expected that the year 1952-53 will see a total of 42 pages.

The budget for the News Supplement for 1951-52 was originally set at $1,530 based on 4,000 copies per issue. With subsequent rapid growth in membership, however, this budget was revised to approximately $2,100 and actual expenses proved to be very close to that figure. The estimated budget for 1952-53 is approximately $2,800.

During the past year, appreciable progress was made in reducing the elapsed time in assembling news, writing the issue, preparing galley, proofreading, printing, and mailing. Where this time was formerly a total of 5 weeks, it is now reduced to 3, and the Supplement reaches most members before the end of the first week of the issue month and about a week before most sectional meetings.

It is planned to continue the publication of the News Supplement on a bimonthly basis and alternately with the issue months of Industrial Quality Control. It is confidently expected that within a year, or two at the most, Industrial Quality Control will be published on a monthly basis. When that time comes, the News Supplement will physically become a department of the magazine. This transaction will undoubtedly take place under the supervision of the new managing editor described by Dr. Wescott in his annual report.

It has indeed been a privilege during the past year to have worked closely with Dr. Wescott in the publication of our News Supplement, and to have shared with him the great pleasure of seeing the tremendous growth in membership and activity of our society.

Respectfully submitted,

Chicago, Ill. *E. H. ROBINSON*
May 9, 1952 Editor, News Supplement

STOCK LIST
ASQC Publications

Publication	Price	Quantity
INDUSTRIAL QUALITY CONTROL Volumes I, II, III, IV, V, VI, VII, VIII (July 1944-May 1952)	$8.00 per Volume including Index	Unlimited
Individual Issues	$1.50 per copy	Unlimited
Library Subscriptions (Current)	$3.00 per year	.....
CONVENTION PROCEEDINGS		
"Abstracts of Papers" Third Annual Convention (41 Papers) Bound Volume	$1.50 per copy	80
"Convention Papers," Fourth Annual Convention (10 Separate Papers) Unbound	$0.30 per paper $2.50 per set of 10 Papers	700
"Quality Control Conference Papers 1952,"—Sixth Annual Convention (47 Papers) Bound Volume	$3.50 per copy	650
MISCELLANEOUS		
"Hamilton Lot-Plot Plan." A reprint.	$0.50 per copy	75
"Second Annual Quality Control Conference Papers," 1950, Middle Atlantic Region. (18 Papers) Bound Volume	$2.50 per copy	20
"Proceedings, Annual Middle Atlantic Regional Conference," 1951. (16 Papers) Bound Volume	$2.50 per copy	19
"Conference Papers" 1951 Sixth Midwest QC Conference (19 Papers) Bound Volume	$2.50 per copy	14
ASTM Manual on Quality Control of Materials	$1.50 per copy	250

Make remittance payable to: American Society for Quality Control. Order from: American Society for Quality Control, Edward B. Haden, Executive Secretary, Room 5036, 70 East 45th Street, New York 17, New York.

AMERICAN SOCIETY NEWS

NEW SECTIONS

The formation of many groups applying for Section status with our Society clearly indicates the continuing growth of our organization. In addition to the Sections mentioned in the July issue, the Allentown-Bethlehem Section was approved by the Executive Committee at its meeting of May 21, 1952, approval to be effective when certain conditions have been met. These conditions have now been met and this Section becomes the 60th Section of the Society. Officers are as follows:

National Director: Max Krissiep, Jr., Western Elec. Co., Allentown, Pa.
Chairman: M. V. Herasimchuk, Bethlehem Steel Co., Bethlehem, Pa.
Vice-Chairman: J. F. Verigan, Atlas Powder Co., Tamaqua, Pa.
Secretary: W. L. Gillette, Western Electric Co., Allentown, Pa.
Treasurer: J. R. Isken, General Elec. Co., Allentown, Pa.

EVANSVILLE-OWENSBORO SECTION OFFICERS FOR 1952-53:

A Type II error was committed in reporting the officers of this Section in the July issue of IQC. The names given there were those of the officers of the Muncie Section. The correct 1952-53 officer roster for the Evansville-Owensboro Section is as follows:

National Director: William E. Gibbons, Servel, Inc., Evansville, Ind.
Chairman: J. Alfred Davies, General Electric Co., Owensboro, Ky.
Vice-Chairman: David Richards, Jr., Igleheart Bros., Evansville, Ind.
Secretary: Miss Harriet McClurkin, Shane Uniform Co., Evansville, Ind.
Treasurer: Robert Williams, Faultless Caster Co., Evansville, Ind.

EXECUTIVE COMMITTEE MEETING

The first Executive Committee meeting of the 1952-53 year will be held in New York on September 13th and 14th. This meeting will enable the Executive Committee to review and finally formulate plans for the coming year, especially with regard to the plans for setting up divisions of the Society similar to the Textile Division, which has been approved by the Executive Committee and the Board of Directors and is now in active operation.

ANNUAL MEETING—1952

Minutes of the Annual Business Meeting held at the War Memorial Auditorium, Syracuse, N. Y., May 22, 1952. Prior to calling the meeting to order President Weaver gave an opportunity to any member who had not cast his ballot for National Officers for the 1952-53 year and for proposed constitutional amendments to do so. No one present wished to cast a ballot.

1. President Weaver called the meeting to order at 4:15 P.M. and announced that a quorum was present.
2. President Weaver appointed a Tellers Committee consisting of the following:
   Ellis R. Ott, Metropolitan Section, *Chairman*
   Howard Jones, Chicago Section
   Ervin E. Schiesel, Southern Connecticut Section
   Clarence Burdick, Michigan Section
   P. B. Proctor, Metropolitan Section
   The Committee was asked to be prepared to present a summary report at the banquet that day at 9 P.M.
3. President Weaver stated that there had been no meetings of the Board of Directors during the present fiscal year. Meetings of the Executive Committee have been reported in Industrial Quality Control insofar as major items of activity are concerned. Some of them are as follows:
   (a) The Executive Committee has granted charters to 11 new Sections this year:

Lansdale, Pa. (5-25-51)	Dallas-Ft. Worth
Mexico City	San Diego
Wichita	Worcester
Buzzards Bay	Evansville-Owensboro
Huntsville, Ala.	Utica
Albany	

   This makes a total of 59 Sections, including three in Canada and one in Mexico.
   (b) Two new committees have been activated; Membership Roster, and Operations Research.
4. President Weaver announced that there has been extensive committee activity. To give a complete report of each committee would take quite a bit of time. Therefore he gave a digest

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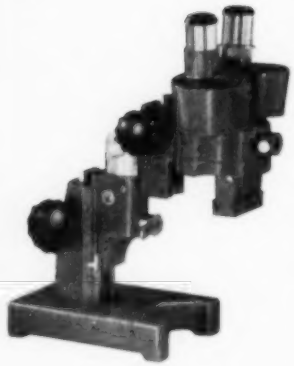

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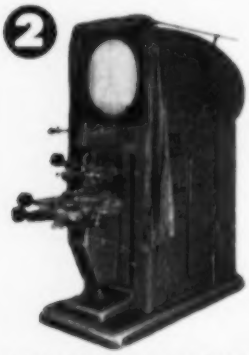

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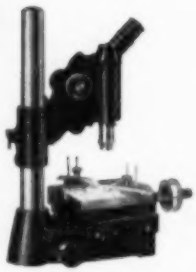

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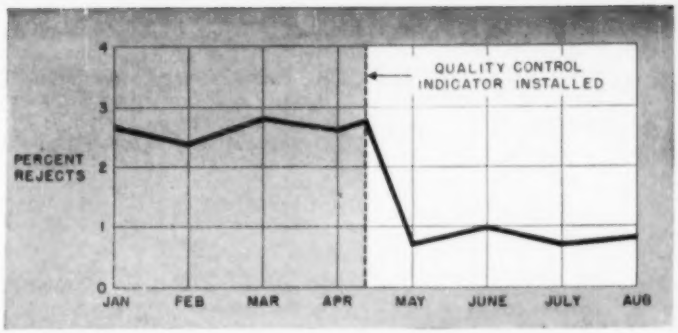
of each report. Mr. Weaver urged all present to participate in committee activity to get the most out of membership in the Society.

5. The Chairman of the Editorial Board presented his report.
6. A motion was passed to accept the report of the Board of Directors as read.
7. The Executive Secretary presented his report. He then asked for any corrections, deletions or additions to the minutes of the previous meeting. The minutes were accepted as read. G. D. Edwards moved that the Society extend to the Executive Secretary its sincere thanks for his long and faithful service. The motion was unanimously passed. The report of the Executive Secretary was accepted as presented.
8. The Treasurer presented his report. G. D. Edwards asked for an explanation as to why, in face of the very substantial excess of receipts over disbursements a reduction in the dues would not be in order. Mr. Weaver replied that it should be recognized that this is a young society, and in spite of the fact that our growth is phenomenal, our obligations seem to increase as rapidly as our growth. We have not given the services that some of our members have asked us to give. We have not been able to pay for these services. It is important that we get ourselves into that position. Part of the profit from our financial position is being reinvested to make a better publication situation. Some day adversity is going to hit this country. At that time we cannot curtail activities by the same means as in an industrial enterprise. There is a strong probability that in such a recession we will have to operate at a loss, and we will have to be able to sustain it. Therefore we should be proud that we have that money and can withstand the pressures that may be brought to bear on us. The report of the Treasurer was accepted as presented.
9. President Weaver announced that the report of the Tellers Committee would be deferred until the banquet program that evening. He then asked whether there was any other business to come before the meeting.
10. Harmon S. Bayer wanted to

know: (a) what the Society is doing in the policing of consultants, and (b) what the Society is doing in the way of increasing the services to its members in a standing placement committee, since this is a problem that is always with us. Mr. Weaver replied: (b) There are several Sections operating on their own with a placement committee. There is no National placement committee, because it takes time and personnel, which we cannot afford yet. However we are progressing in that direction. In the meanwhile the Executive Secretary maintains a placement service, and space in Industrial Quality Control is available for classified ads. (a) The Society is in no position to act as a good-housekeeping institute to approve qualification and disqualification. It's a free country. If a man wants to call himself a consultant there is nothing we can do about it. If he is good he will do all right; if not he will be found out. Some damage will be done, but the individual who is being damaged is rather thoughtless about his procedure. He should look up the man's qualifications. We know of no way we can judge whether a man is qualified to act as a consultant.

11. With reference to the question of a placement committee on a national scale, C. L. Matz observed that it has been a perplexing problem. We are in the position of having more applicants than positions open. It might be an appropriate move to utilize the facilities of Industrial Quality Control magazine to give more publicity to positions open and wanted, like other technical societies. This particular phase should be strengthened. Mr. Weaver replied that this was a good suggestion, particularly applicable when the Society can see its way clear to a monthly publication. It is one of the reasons why we should if possible have a monthly publication. We can do little under the circumstances to develop this and have to rely on Section activities in this respect.
12. There being no more business before the meeting, it was recessed until approximately 9 P.M. to hear the report of the Tellers Committee.



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METALS TECHNICAL COMMITTEE

In response to a formal petition executed by ten members in good standing and actively interested in and engaged in the above fields, President Weaver, as one of his last official acts of office activated the Metals Technical Committee. The following have been asked to serve in the capacities indicated:

Chairman: John W. W. Sullivan, American Iron & Steel Institute

Vice Chairmen: F. G. Norris, Wheeling Steel Corporation

D. H. W. Allan, The Steel Company of Canada, Ltd.

W. P. Goepfert, Aluminum Company of America

Immediate objectives of this committee will be the evaluation and reporting of statistical methods which are useful in the solution of research development, production, and inspection problems of the metals industries. The committee will also offer integrated programs for the consideration of those planning the technical programs for National Conventions.

Individuals desiring to participate in committee activities, serve on task forces, etc., are asked to contact the Committee Chairman, Mr. John W. W. Sullivan, American Iron and Steel Institute, 350 Fifth Ave., New York 1, N. Y.

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PROPOSED CHEMICAL DIVISION

The Chemical Technical Committee has obtained the signatures of sixty ASQC members to a petition requesting the establishment of a Chemical Division within the Society. At the suggestion of the President the Committee Chairman, Rolly Noel, has appointed a steering committee to investigate and recommend organizational details. All interested members are asked to contact Mr. R. S. Bingham, Jr., Hercules Powder Co., Inc., Wilmington, Del., Chairman of that committee.

HISTORICAL COMMITTEE APPOINTED

The long series of events leading up to the formation of the SOCIETY FOR QUALITY CONTROL and the subsequent incorporation of the AMERICAN SOCIETY FOR QUALITY CONTROL, INC., are a matter of great historical interest. In order that all these events may be properly chronicled and adequately documented, President Weaver asked approval of the Board of Directors to appoint an Historical Committee. Upon obtaining such approval the following were appointed, and have agreed to serve:

Walter S. Oliver, Detroit Gear Div., Borg-Warner Corp.

Ralph A. Hefner, Georgia Institute of Technology

Edward M. Schrock, Lukens Steel Company

Walter Oliver will serve as Chairman and has already activated the Committee. Any individual possessing any particular documents, papers, knowledge, etc., pertaining to the period prior to February 16, 1946, which he feels will be of interest or value to the committee in implementing its assignment, is requested to contact Walter at Borg-Warner Corp., Detroit 14, Michigan.

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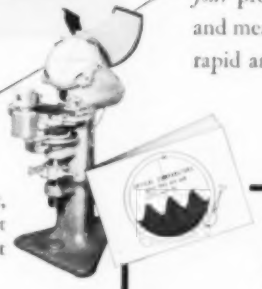

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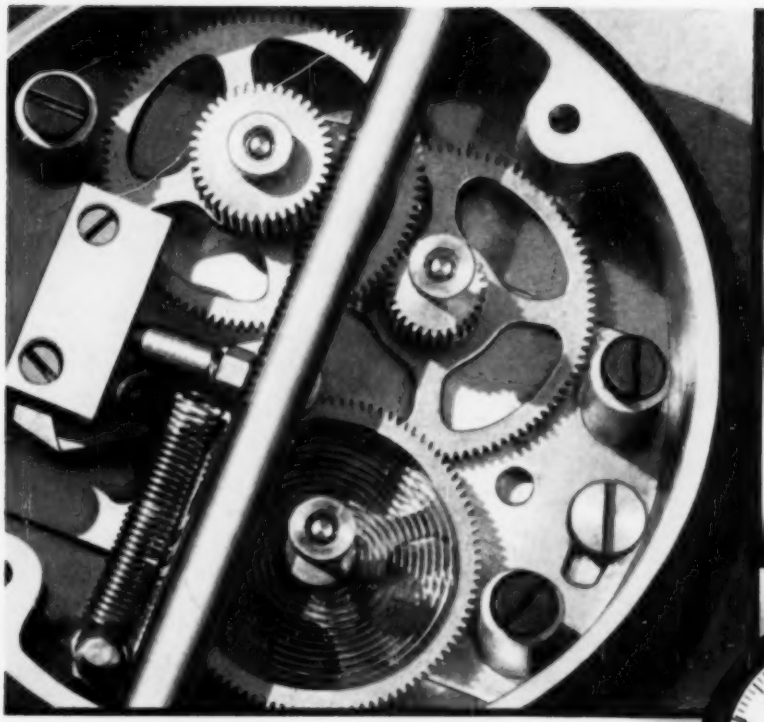

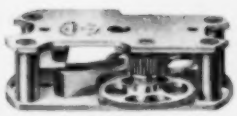

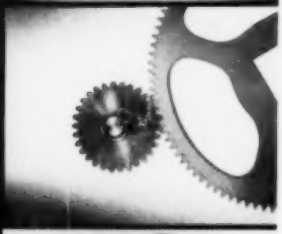

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And, finally, a Dial Indicator must have the stamina and durability to withstand sudden shock and rough abuse.

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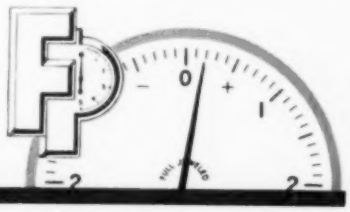
Send for Federal's latest catalog showing the most complete line of Dial Indicators and Indicating Gages. FEDERAL PRODUCTS CORPORATION, 1150 Eddy Street, Providence 1, Rhode Island.

ABOVE ILLUSTRATIONS
(Top to Bottom)

Note rigid assembly of top and bottom plates and massive support for pinion bearing — features which mean long lived accuracy.

Bottom plate of heavy gage brass showing jeweled bearings and precision workmanship.

Teeth of gears and pinions are cleanly cut — not stamped — and they mesh accurately.

FEDERAL

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